VOL. 45 JULY 1919 No. 197

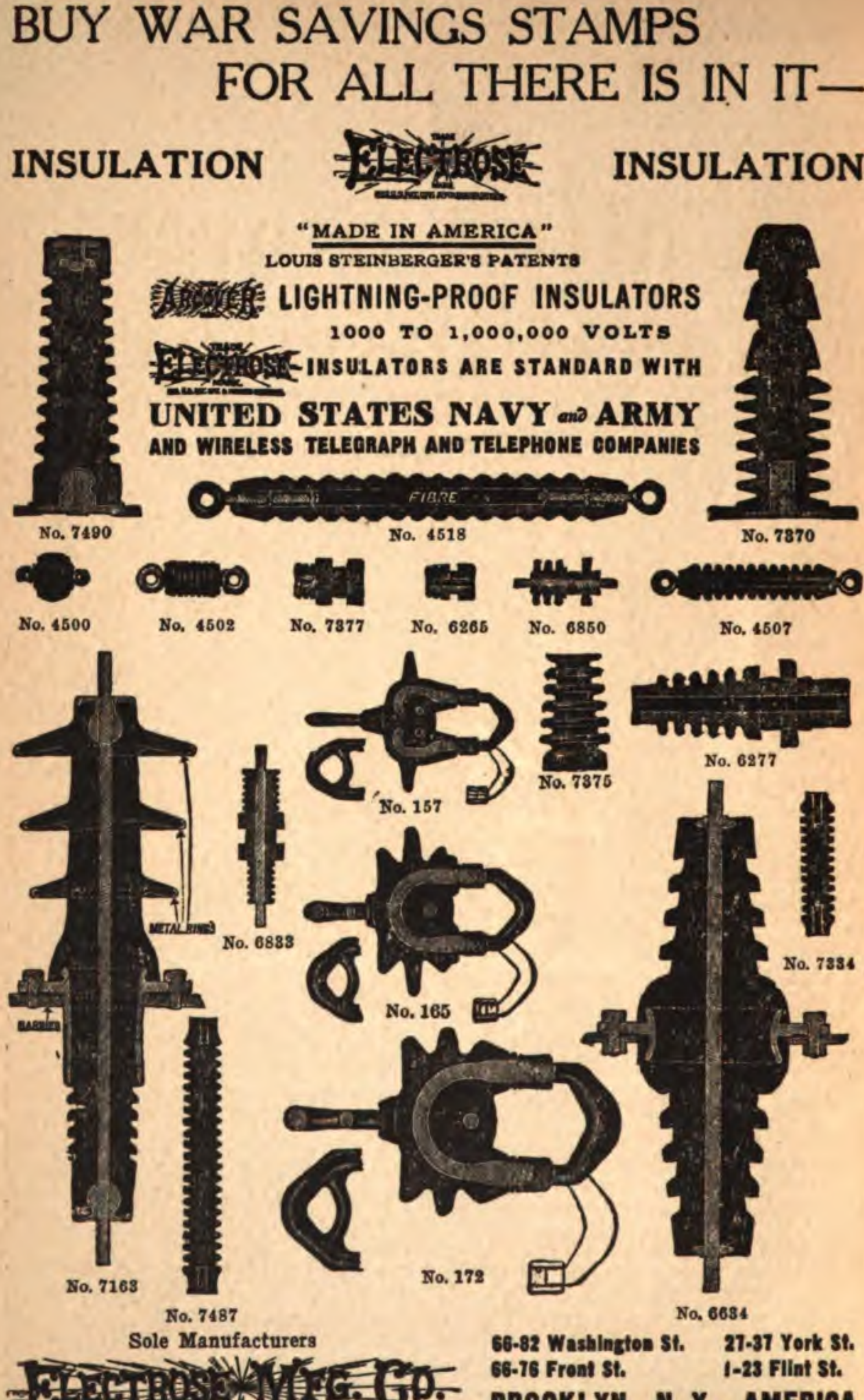
United States Naval Institute

Proceedings

The writers only are responsible for the contents of their respective articles

CONTENTS

Entered at the Post Office at Annapolis, Maryland, as Second Class Matter


BUY WAR SAVINGS STAMPS
FOR ALL THERE IS IN IT—
INSULATION
ELECTROSE
INSULATION
"MADE IN AMERICA"
LOUIS STEINBERGER'S PATENTS
LIGHTNING-PROOF INSULATORS
1000 TO 1,000,000 VOLTS
ELECTROSE INSULATORS ARE STANDARD WITH
UNITED STATES NAVY and ARMY
AND WIRELESS TELEGRAPH AND TELEPHONE COMPANIES
FIBRE
No. 7490
No. 4518
No. 7370
No. 4500
No. 4502
No. 7377
No. 6265
No. 6850
No. 4507
No. 6277
No. 7375
No. 157
METAL RINGS
No. 6833
No. 7334
No. 165
No. 7163
No. 172
No. 7487
No. 6634
Sole Manufacturers
ELECTROSE MFG. CO.
66-82 Washington St.
66-76 Front St.
27-37 York St.
1-23 Flint St.
BROOKLYN, N. Y., AMERICA

Vol. 45, No. 7 July, 1919 Whole No. 197

United States Naval Institute
Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

CONTENTS

OFFICERS OF THE INSTITUTE

President

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

Vice-President

REAR ADMIRAL A. H. SCALES, U. S. NAVY

Secretary and Treasurer

COMMANDER G. M. RAVENSCROFT, U. S. NAVY

Board of Control

CAPTAIN DAVID POTTER, P. C., U. S. NAVY
CAPTAIN W. T. CLUVERIUS, U. S. NAVY
CAPTAIN T. L. JOHNSON, U. S. NAVY
CAPTAIN E. J. KING, U. S. NAVY
CAPTAIN W. Y. DU BOSE, CONSTRUCTION CORPS, U. S. NAVY
COMMANDER G. M. RAVENSCROFT, U. S. NAVY (*ex officio*)

PAST PRESIDENTS

OF THE

U. S. NAVAL INSTITUTE

ADMIRAL DAVID D. PORTER, U. S. NAVY, 1873
REAR ADMIRAL JOHN L. WORDEN, U. S. NAVY, 1874
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1875–JAN. 1878
COMMODORE FOXHALL A. PARKER, U. S. NAVY, JAN. 1878–JAN. 1879
REAR ADMIRAL JOHN RODGERS, U. S. NAVY, JAN. 1879–JAN. 1882
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1882–JAN. 1883
REAR ADMIRAL THORNTON A. JENKINS, U. S. NAVY, JAN. 1883–OCT. 1885
REAR ADMIRAL EDWARD SIMPSON, U. S. NAVY, OCT. 1885–OCT. 1887
REAR ADMIRAL STEPHEN B. LUCE, U. S. NAVY, OCT. 1887–OCT. 1898
REAR ADMIRAL WM. T. SAMPSON, U. S. NAVY, OCT. 1898–OCT. 1902
REAR ADMIRAL H. C. TAYLOR, U. S. NAVY, OCT. 1902–OCT. 1904
REAR ADMIRAL C. F. GOODRICH, U. S. NAVY, OCT. 1904–OCT. 1909
REAR ADMIRAL RICHARD WAINWRIGHT, U. S. NAVY, OCT. 1909–OCT. 1911

MOUNTS LINED UP IN PHILADELPHIA NAVY YARD.

UNITED STATES
NAVAL INSTITUTE
PROCEEDINGS

Vol. 45, No. 7 JULY, 1919 Whole No. 197

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

DESTRUCTION OF THE FLANDERS TRIANGLE

By Lieutenant Z. W. Wicks, U. S. Navy

The first and only real offensive against the German submarine menace in the North Sea and adjacent waters was the attack, successfully carried out, against the submarine base in Flanders. The attack took place on the night of April 22 and 23, 1918, but owing to the miscarriage of a portion of the plan a second attempt at Ostend had to be made. This was accomplished on May 10, 1918.

Zeebrugge Harbor is an open one protected by a quadrantal mole which is connected at one end to the mainland by an iron viaduct. The entrance is well protected on the land side by shallow water. During the German occupation the channel was equipped with a strong net and barge barrier.

This harbor is connected by a ship canal with the inland docks at Bruges, which are further connected to Ostend Harbor by a system of smaller canals. The whole forms a triangle with Bruges at the apex and a sea entrance at each end of the base. The two legs are 8 and 11 miles long respectively and the base 12 miles. At the time this operation was conducted the base of this triangle was heavily fortified and the defences extended along the coast, eastwardly to the Dutch frontier and westwardly to the right flank of the German Army operating before Nieuport. The strength of this stretch of coast, 27½ miles in length, could be reckoned in the number of guns installed, more than

225, or an average of at least 8 to the mile, of which 136 were of not less than 6-inch caliber and some as large as 15-inch, the last ranging up to 42,000 yards.

The Straits of Dover and the English Channel formed a sector of the main line of communication of the British Army and had been greatly harassed by the attacks delivered by the submarines operating from this strongly held base. The proximity of the objectives to the base added greatly to the efficient performance of the smaller types of submarines. After getting in an attack they could make the coast of Flanders before being detected and return to their base under the protection of their shore batteries.

Mission.—The objective of this offensive can be classed as primary and secondary. The primary objective was to block the Bruges ship-canal at its entrance in the harbor of Zeebrugge, and to block the entrance to Ostend Harbor from the sea; a successful accomplishment of which would have meant, practically, the destruction of the triangle, leaving only its fortified base as of military importance. The secondary objective was to accomplish as much damage as possible to the fortified ports of Zeebrugge and Ostend, or in other words to the base of the triangle, while at the same time causing a distraction from the main attack.

Plan of Attack.—With the objectives clearly defined it was necessary to draw up a comprehensive plan of attack before the preparation of material and the training of the personnel could be undertaken, on account of the singularity of the operation.

The following summary of suppositions and decisions is offered by the writer to show what the undertaking faced and is considered sufficient for a clear understanding without encumbering the narrative with a mass of technical detail.

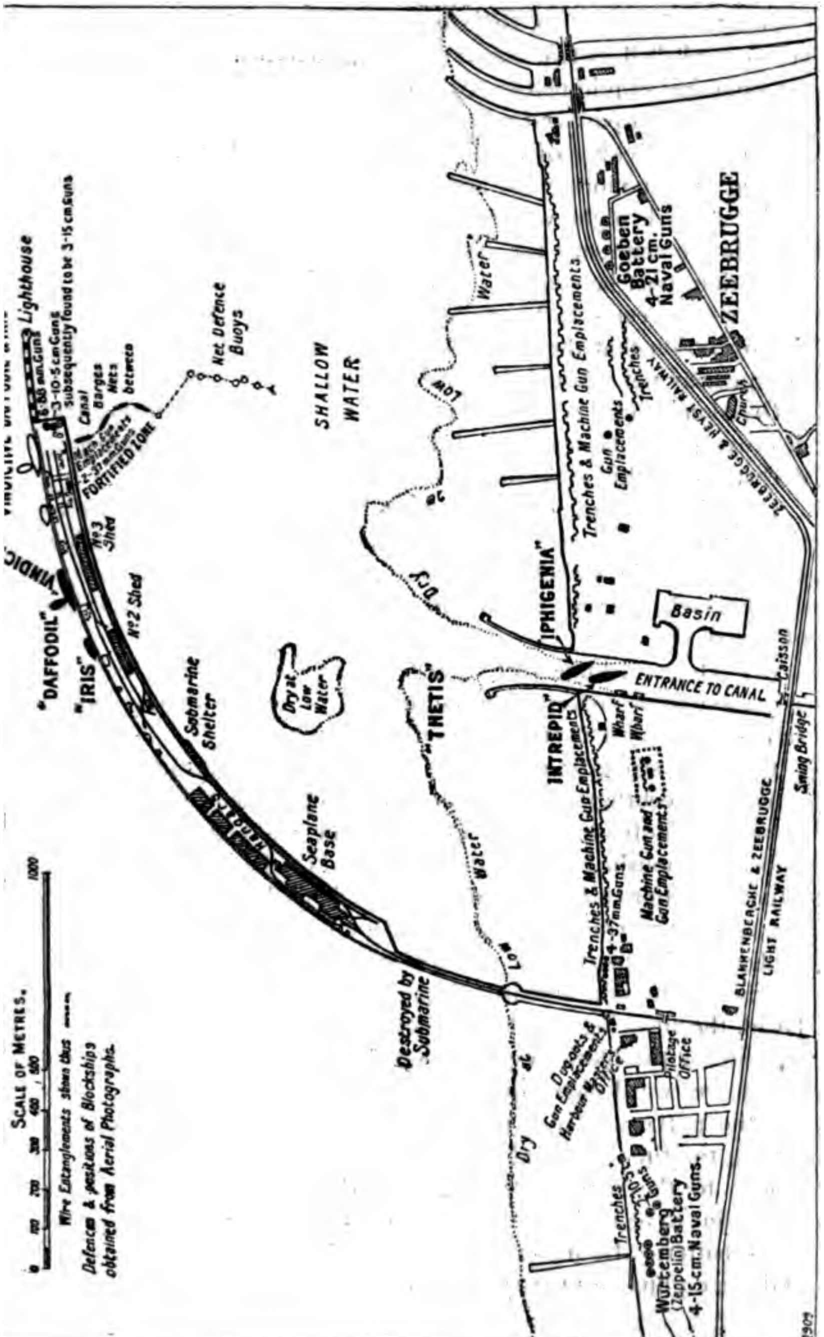
Suppositions.—(a) A strong German raiding or patrol force might be encountered.

(b) It was believed that the shallow waters in the vicinity of Zeebrugge and Ostend were heavily mined.

(c) A strong counter-attack by the German destroyer flotilla lying behind the Zeebrugge Mole might be expected.

(d) Good protection was afforded the entrance of the Zeebrugge-Bruges Canal by the Mole, heavy shore batteries and shoal water.

(e) During an attack on the Mole the defenders could receive reinforcements from land over the iron viaduct.



ZEEBRUGGE HARBOR WITH GERMAN DEFENCES AND BRITISH BLOCKSHIPS.

(f) The blocking of the canal entrance at Zeebrugge could be accomplished in two ways: (1) Ram the lock gates and sink the ramming ship in place; (2) sink two ships across the entrance at its narrowest part and rely on silting to complete the operation.

(g) The blocking of the Ostend entrance could be fulfilled by sinking one or more ships across the channel between the piers.

(h) A dark night with absence of fog and a certain state of the tide are necessary for maneuvering the force. Some kind of protection must be provided to conceal the approach.

Note.—It seems to be evident from the published reports of this operation that the probable presence of a harbor net at Zeebrugge was not taken into consideration.

Decisions.—(a) A strong covering force of light cruisers and destroyers is to be maintained to the eastward and northward of Zeebrugge. This force to be drawn from Harwich.

(b) The presence of mines must be expected and the operation must proceed without taking them into account. Shallow draft vessels in sufficient number must accompany the deeper draft vessels in order to take off all personnel in case of the loss of any of the latter.

(c) The attacking force must be accompanied and covered by a force of destroyers sufficient to repel an attack by the enemy's full force of destroyers based on Zeebrugge.

(d) The strength of the protection of the entrance to the canal at Zeebrugge necessitates the employment of feints to attract the defender's attention from the main attack. This is to be accomplished by two means, viz: (1) the bombardment of adjacent batteries by monitors (covered by destroyers) and airplanes on prearranged targets; (2) an attack in force on the Mole, the landing to be effected on the seaward side and as nearly as possible abreast of the battery located on the Mole Head, the silencing of which is considered necessary for the safe passage of the block ships. Then the attack is to be continued to the westward along the Mole followed by a demolition party for the purpose of accomplishing as much damage as possible during the time required to carry out the main operation.

Due to the exposed entrance of the harbor at Ostend the only feint to be undertaken will be the heavy bombardment of the shore batteries by monitors (protected by destroyers), airplanes and siege guns on preassigned targets.

(e) In order to prevent reinforcements reaching the defenders of the Mole the iron viaduct must be destroyed. This is to be accomplished by fitting two old submarines with large quantities of explosives, ramming the viaduct from the seaward side and detonating the charges.

(f) Three block ships are to be used at Zeebrugge. The block ships will proceed into the canal, timed to arrive about 25 minutes after the opening of the attack on the Mole. The leading ship, if her consorts are seen to be following, is to ram the lock gates and be sunk, the other vessels are to be run ashore near the entrance at the southern end of the piers, the narrowest part of the channel, and to be sunk. If the leading vessel should fail to reach the lock gates and should sink in the channel short of them she would make no obstruction. If only two of the block ships reach the canal they are to be sunk across the channel near the southern end of the piers.

(g) Two block ships are to be used at Ostend. Each ship in turn will ram one of the piers and then swing the ship across the channel in which position the sinking charges will be exploded.

(h) A smoke screen must be laid close to the enemy's position, to be laid down after the commencement of the bombardment, but before the arrival of the force for the attack on the Mole and of the block ships. Flotillas of motor launches and coastal motor boats are to be used for this duty and they will have rescue work as an additional duty.

Composition of Forces.—In order that all parts of the English Naval Service might share in this expedition officers and men were drawn from all parts of the home forces. The ships, destroyers and small craft were drawn from the Dover patrol, Harwich force and Dunkirk, augmented by eight destroyers and four motor launches from the French Navy. The block ships and submarines were obtained from Portsmouth and the Nore.

The total force was composed as follows:

Monitors	8	Parent ships, etc.	3
Light cruisers	8	Block ships	5
Flotilla leaders	7	Submarines	2
Destroyers	45	Mine-sweepers	1
Motor launches	62	Auxiliary craft	2
Picket boat	1	Airplane squadrons	2
Coastal motor boats	24		

In addition to the crews of such of the above ships as were in commission there was a force of 82 officers and 1698 men—Royal Navy 50 officers and 980 men, Royal Marines 32 officers and 718 men—for the manning of the other ships and the formation of the storming and demolition parties.

Preparation.—A force thus composed and its weapons obviously needed collective training and special preparation to adapt them to the purpose.

The *Vindictive* was chosen to make the attack on the Mole. She was fitted out at the Chatham Dockyard with special fenders, mole anchors for making fast to the Mole, and brows to expedite the landing of the attacking force. Her light gun armament was increased especially by the placing of machine guns and flame throwers.

Two special craft were necessary to accompany the *Vindictive.* The Liverpool ferry-steamers *Iris*—renamed *Iris II*—and *Daffodil* were selected after a long and careful search on account of their power, large carrying capacity and shallow draft. They were chosen with the view of pushing the *Vindictive* alongside of the Mole; bringing away all of the crew and landing parties of the *Vindictive* if she should be sunk; and their ability to maneuver in shallow water and to clear mine fields and torpedoes. They were refitted for this work much in the manner as the *Vindictive* at the Portsmouth dockyard.

The following ships were selected for block ships: At Zeebrugge, the *Thetis, Intrepid* and *Iphigenia;* at Ostend, the *Sirius* and *Brilliant.* Their holds were filled with cement and two sets of explosive charges were installed in each vessel at the Chatham dockyard.

The smoke producing apparatus in vogue was only intended for day use and was entirely unsuitable for this expedition as its combustion was accompanied by a bright flame. A new and satisfactory system was evolved by Wing Commander F. A. Brock, later killed during the attack. This equipment was manufactured and installed on the motor launches, coastal motor boats and destroyers at Dover.

As soon as the preparation of the material was sufficiently advanced the training of the personnel was commenced. With this end in view the block ships and the storming forces were assembled at Chatham towards the end of February. The *Hin-*

dustan was used as receiving ship and training depot. On the 4th of April this force was moved to the West Severn anchorage.

The storming forces were composed as follows: Naval companies A, B and D; and the 4th Battalion of Royal Marines, companies A, B, C and machine gun. The demolition force was known as the Naval Company C and was divided into three sections.

For several weeks the 61st Wing was engaged in frequent aerial reconnaissances and took a large number of photographs in different conditions of the tide, from which plans and models were constructed. The storming and demolition parties were trained on a replica of the Zeebrugge Mole until each company became thoroughly acquainted with its share of the undertaking. This training was carried out in accordance with a plan to place the *Vindictive* abreast of the battery on the seaward end of the Mole.

To assure the efficient co-operation of all of the various forces it was found necessary to place navigational marks at certain turning points and to mark the positions to be taken by the monitors in order to assure the bombardment of all preassigned targets. This was well accomplished except at Ostend, where too much confidence was placed on the Storm Bank Buoy.

In order that the attack might have a reasonable prospect of success the following conditions were essential, viz: (a) a certain state of the tide in conjunction with darkness; (b) relatively calm weather; (c) more or less favorable direction of the wind; (d) absence of fog. The first of these fixed the dates between which it was practicable to make the attempt. The others it was not possible to reckon with in advance, owing to the uncertainty of the weather at that time of the year, owing to the fact that the weather conditions on the Flanders coast might be different than they were off the Goodwins and owing to a possible change in the seven hours necessary to make the passage from the point of concentration to the point of attack.

On two occasions previous to April 22d, the concentration took place, but on account of unfavorable weather conditions setting in, had to be dispersed. Although this caused great disappointment to the personnel it had considerable practical value as dress rehearsals of the preliminary stages of the undertaking.

The last of the preparations was the long-range bombardment of the Flanders coast, carried out on several nights prior to

The monitors and their destroyer covering forces, having proceeded independently to their stations, commenced the bombardment of the defences of Zeebrugge and those of Ostend simultaneously at 11.20 p. m. This bombardment had been slightly delayed by the strong set of the tide and the presence of thick weather along the Flanders coast. The drizzle and low clouds prevented the operation of the 65th Wing which was to have assisted in the attack on Ostend.

ZEEBRUGGE.—At 11.30 p. m., the *Vindictive* had the Blankenberghe light buoy abeam and the Germans had apparently seen or heard the approaching forces, as many star shells were fired, lighting up the vicinity and revealing no enemy patrol vessels to the attacking force. At this time the wind which had been from the northeast and favorable to the smoke screen died out and soon sprung up from a southerly direction.

The flotilla of 24 motor launches and 8 coastal motor boats which had been detailed for laying the smoke screen commenced its operations when the C. M. B.'s ran in close to the Mole and started dropping their smoke boxes at 11.40 p. m. This operation continued steadily and the flotilla was subjected to a heavy fire, but suffered little damage on account of their small size and high speed. The effectiveness of the screen was lessened considerably by the adverse direction of the wind and by the sinking of many of the floats by shell fire from the shore batteries, especially those which showed a flame and those which were placed near the end of the Mole.

The Mole Attack.—The attack on the Mole was primarily to distract the enemy's attention from the ships engaged in blocking the Bruges Canal. Its first objective was the capture or silencing of the battery located on the seaward end of the Mole, which was a serious menace to the passage of the block ships. Its second objective was the execution of as much damage as possible during the time necessary for the block ships to accomplish their mission.

When the *Vindictive* arrived at the position where it was necessary for her to alter course for the Mole, the three destroyers, *Warwick, Phoebe* and *North Star,* bore off to starboard and cruised in the vicinity of the Mole and covered the landing. These destroyers were also employed in assisting the small craft to maintain the smoke screen.

At 11.56 p. m., the *Vindictive* having just passed through the smoke screen, the Mole extension was sighted about 300 yards on her port bow. The Mole was closed at full speed and on such a course as, with the cross tide, made the closing angle about 45 degrees. As soon as the ship emerged from the smoke screen she was subjected to a heavy fire and in turn opened fire almost simultaneously with her port battery. The storming parties suffered severely under this fire; the commander of the Naval Battalion and the commander and second in command of the Marine Battalion were all killed.

At one minute after midnight on April 23—the programme time having been midnight—the *Vindictive* was put alongside of the Mole, taking up on the special fenders on her port bow, and the starboard anchor was let go. As there was some doubt of the latter having dropped clear, the port anchor was dropped under foot and hove in to short stay. A 3-knot tide running past the Mole and the scend created by a slight swell caused the ship to roll considerably.

At 12.04 a. m. the *Daffodil,* closely followed by the *Iris II,* arrived. The former immediately took up position and pushed the *Vindictive* bodily against the Mole. Two brows were gotten over from the forecastle of the *Vindictive* and in spite of the heavy see-sawing of the ends on the Mole, due to the motion of the ship, the landing parties commenced to land under heavy fire. Their first duty was to place the special mole-anchors. The forward one was broken up between the ship and the Mole as it was being carried out. The rest were soon in place and two brows aft were run out.

It had been intended for the *Daffodil* to go alongside the *Vindictive* to land her detachment of the storming force, but it was found necessary to keep her holding the *Vindictive* against the Mole throughout the action. The portion of the landing parties aboard her disembarked over her bow to the *Vindictive,* thence ashore.

The *Iris II* went alongside the Mole ahead of the *Vindictive*. The scend alongside caused her to bump heavily and the use of her scaling ladders was difficult and dangerous. Her two mole-anchors were secured under the most trying conditions, the two officers who performed the work being killed. However, it was impossible to get them to hold and in the end the *Iris II* dropped

down alongside of the *Vindictive*. The disembarkation of her detachment of the storming party had only commenced when the retiring signal was given.

The first to land on the parapet, the raised portion of the Mole on the seaward side with a drop of 15 feet to the Mole proper, were A and B companies of the Naval Battalion, D company being embarked on the *Iris II*. To them had been assigned the duty of silencing the battery on the Mole Head. Due to the impossibility of recognizing objects in the semi-darkness the *Vindictive* had overrun her intended position about 400 yards. Hence

ZEEBRUGGE HARBOR.

these two companies found a fortified zone between them and their objective.

This force was soon followed by Companies B and C and part of the Machine Gun Company, platoons 5 to 12 inclusive, of the Royal Marines. Company A and the remainder of the Machine Gun Company were on board the *Iris II*. To these had been assigned the mission of taking the fortified zone, referred to in the preceding paragraph, and then to proceed to the westward along the Mole and hold a position which would protect the demolition parties.

The two naval companies, considerably reduced in effectives by their losses on the *Vindictive,* but accompanied by a detachment of flame throwers, advanced along the parapet to the eastward. A look-out or control station was encountered and a

bomb thrown into it. However, it was unoccupied. In its vicinity there was an iron ladder leading to the Mole proper. Three of the party descended for the purpose of preventing the passage of the defenders. The rest of the party proceeded to a point about 40 yards eastward of the look-out station and held a position protected from fire from the direction of the Mole Head, but exposed to the machine gun fire of the destroyers lying alongside the Mole. The force was too small to carry the fortified zone by assault and reinforcements were sent for.

THE SHATTERED VIADUCT.

Number 5 platoon of the Marines was the first of the battalion to land. It advanced along the parapet to the westward, silenced a party of snipers in No. 2 Shed and took up position about 200 yards from the *Vindictive*. The 9th and 10th platoons soon followed and descended to the Mole by ropes secured to the iron railing. They took up a strong position at the landward end of No. 3 Shed. Number 7 platoon following close behind fixed heavy scaling ladders in position from the parapet to the Mole and then took up a supporting position on the 9th and 10th platoons.

The rest of the Marines and the demolition company, in the meantime, had landed and were forming on the parapet when at 12.20 a. m. the Mole was successfully cut off from the shore. After slipping the tow of the destroyer the submarine *C-3* pro-

ceeded under her own power and shortly after midnight sighted the viaduct ahead, distant about one and a half miles. Soon after this the light of a star shell exposed her and she was subjected to shell fire for a short period. When about a half mile off, an opportune flare, on the far side, silhouetted the Mole and viaduct which showed two points on the port bow. At this point two searchlights were turned on her but quickly taken off. Her course was changed, when 100 yards off, to ensure striking exactly at right angles. At 12.15 a. m. the *C-3* struck exactly between two rows of piers at a speed of nine and a half knots. Riding up on to the horizontal girders of the viaduct and raising the hull bodily about two feet, she penetrated up to the conning tower.

The crew, having been mustered on deck before the collision, lowered and manned the motor skiff with which the submarine had been equipped. The fuses were lighted and the vessel abandoned. As soon as the skiff shoved off from the submarine the two searchlights were again switched on and the craft was subjected to heavy machine-gun and rifle fire. The skiff's propeller had been damaged, so oars were broken out. As only slow progress could be made against the tidal current by this means the skiff was only a short distance off when, at 12.20 a. m., the *C-3* exploded. The two searchlights were immediately put out and the firing became spasmodic. Three members of the crew were wounded and the skiff badly holed before they were picked up by the picket boat detached for that purpose. It is well to note at this point that the *C-3* had been equipped with a gyrosteering gear in order to permit the abandoning of the craft at a safe distance. The use of this was ignored in order to make as certain as possible the successful carrying out of the mission.

During this time the port 6-inch battery, the forward 7."5 howitzer and machine guns in the top of the *Vindictive* were covering the operations in an excellent manner. At the forward howitzer two gun's crews were practically wiped out. The ship was being hit every few seconds, especially in the upper works. Two direct hits were made on the fore-top, killing all but one marine sergeant, who continued to operate a machine-gun until a third shot demolished the top. The operations were well lighted by rockets from the *Vindictive* and German star shells.

While awaiting the coming of reinforcements Naval Companies A and B made a spirited attack along the parapet, but were stopped with heavy losses. The 11th and 12th platoons of Marines were dispatched to their assistance and advanced as far as the look-out station. They were prevented from joining the naval companies by the heavy fire which swept the parapet between the two forces. Meanwhile the 5th platoon was recalled from its advanced position. This platoon with the 7th and 8th were formed for an assault on the fortified zone and the attack was launched.

While these operations were proceeding, the demolition party, Naval Company C, had landed and proceeded to No. 3 Shed. The heavy fire of the destroyers alongside of the Mole prevented the 9th and 10th platoons from advancing beyond the end of this shed; hence its demolition was impossible. However, charges were placed and everything made ready in case the opportunity occurred. An attempt was made to place a charge alongside of the destroyers but it was repulsed by their fire, but not before a few bombs were thrown aboard. This party was on the Mole for about three-quarters of an hour and only the proximity of the storming parties prevented considerable destruction.

Before the newly launched attack on the fortified zone was fully developed the general recall was sounded, which occurred about 12.50 a. m. The two naval companies and the 5th, 7th, 8th, 11th and 12th Marine platoons, bringing their wounded with them, retired in good order along the parapet and commenced the re-embarkation. Although this force did not complete its mission, its fire against the Mole Head battery was no doubt instrumental in preventing that battery from firing on the block ships.

The retiring of the 9th and 10th platoons and the demolition party was not so easily accomplished. Several of the scaling ladders from the Mole to the parapet had been destroyed by shell fire. This section of the Mole was being raked by the Germans and the men were sent across in small batches from the comparative shelter of No. 3 Shed. Such rushes took place as far as possible in the intervals between the bursts of fire.

By 1.10 a. m. the withdrawal was completed and five minutes later the *Vindictive* and her two consorts were clear of the Mole, the bow of the *Vindictive* having been towed out by the *Daffodil.* While drawing away, the *Iris II* was especially sub-

jected to heavy fire from the Mole and shore batteries. She was struck by 13 small shells and two large ones, one of the latter carrying away the port side of the bridge and starting a fire in the vicinity of the ammunition. *M. L.-558* came to her assistance and threw up a heavy smoke-screen between her and the shore which enabled her to get clear. The *Iris II,* in a very badly damaged condition, made Dover at 2.45 p. m., the *Vindictive* having arrived at 8. a. m.

It had been planned to use two submarines to destroy the viaduct. The *C-1,* owing to the delay caused by the parting of the tow-line, did not arrive in the vicinity of the viaduct until after the retirement had commenced. Her commanding officer, realizing that the engagement was over and considering that the boat might be required at another time, withdrew.

Blocking Operations.—The mission of the block ships has been given in the brief of Decisions. *M. L.-110* was detailed to precede the block ships into the harbor and to light the entrances of the harbor and of the canal with calcium flares. While approaching the entrance she was struck by three shells which killed and wounded half of the crew and wrecked the engines. The craft was abandoned and soon sank.

The three block ships proceeded in column in the following order: *Thetis, Intrepid, Iphigenia.* Shortly after midnight the *Thetis* sighted the Mole ahead and signalled this fact to the ships astern. The Mole Head and extension were lighted up by rockets fired from the *Vindictive* and *M. L.-558* hailed and gave the bearing of the lighthouse.

The *Thetis,* having rounded the lighthouse at 12.15 a. m.—on time in accordance with the arrangements—sighted the barge-boom across the channel. She proceeded at full speed towards the barge furthest from the Mole, and at the same time opened fire at the lighthouse, later shifted to the inshore barge, which was sunk by shell fire. The ship was subjected to a heavy fire from the light guns on the Mole extension, but apparently received no fire from the heavier battery on the Mole Head.

As the *Thetis* approached what appeared to be an opening between the barges and the net obstruction extending to the southeastward of them, she was given hard right rudder, but ran into the net between the two end buoys. She continued to forge ahead and carried the nets with her, thus clearing a pas-

sage for the ships behind her. The piers of the canal entrance were in sight when both of her engines brought up due to fouling of the propellers by the net. The tide quickly carried her shoreward and she grounded about 300 yards from the eastern pier. Whereupon she signalled the other ships to pass to starboard of her and turned on her starboard running light which aided in showing up the canal entrance.

At this time she had a list to starboard and was settling down, having been holed at the water-line on the starboard side several times. She continued to be hit from the Mole, from craft alongside of it and from the shore batteries to which she replied with the forecastle 6-inch gun until her own smoke made it impossible to see. By the time the other two ships had passed, her starboard engine was started. The vessel moved ahead but her bow swung off to starboard into the dredged channel. As the ship was in a sinking condition the order was given to abandon ship and the sinking charges were fired by the after set of keys. They detonated well and the ship quickly sank. The crew abandoned ship in the one remaining cutter and were soon picked up by *M. L.-526,* which had followed in for that purpose and was lying close by. From the aerial photographs which were taken after the action, it appears that the *Thetis* made her way entirely across the dredged channel under her starboard engine, before she finally sank.

The *Intrepid* had been unable to get rid of her spare fire-room watch, on account of the *M. L.* not getting alongside, and hence proceeded to her mission with a crew of 87 officers and men instead of 54. On approaching the Mole she was subjected to a heavy shrapnel fire. She rounded the lighthouse, passed the *Thetis* on her port hand and steered for the canal entrance. Few guns fired at her as most of the firing was directed against the Mole and the *Thetis*. On reaching her assigned position in the entrance she was turned to port under hard left rudder, starboard engine full speed ahead and the port one full speed astern.

The order was given to abandon ship, but before all of the crew had disembarked the ship picked up sternway and her bow drew away from the eastern bank where it had grounded. The sinking charges were immediately exploded and the ship sank, only partially blocking the channel. Ship was abandoned in two cutters and a Carley life-raft. One of the cutters was picked

up by *M. L.-526,* the other by the destroyer *Whirlwind* and the two officers and four men on the life-raft by *M. L.-282,* which had been brought right into the channel, under heavy fire.

The *Iphigenia* also had not succeeded in discharging all of her extra steaming watch and was therefore encumbered with extra men. She was subjected to shrapnel fire the same as the *Intrepid,* while approaching the Mole. Just as she rounded the lighthouse a star shell showed up the *Intrepid* headed for the canal and the *Thetis* aground. While passing towards the canal entrance she was holed twice; one shell cut the siren steam-pipe and thus the fore part of the ship was enveloped in steam.

The entrance became obscured by smoke so that the *Iphigenia* ran in between a dredge and barge. She cut them apart and pushed the barge ahead of her into the canal. At this point it was noted that the *Intrepid* was aground on the western bank with a gap between her and the eastern shore. Having cleared the barge, the *Iphigenia* went ahead full speed to close this gap and collided with the port bow of the *Intrepid.* But her beam was not sufficient to complete the blocking of the entrance at that point. She was backed clear of the *Intrepid* and her engines put full ahead. As soon as she gathered headway she was turned to port under hard left rudder assisted by her engines. She quickly grounded at the bow on the eastern bank and laid completely across the channel with her stern on the western shoal. At 12.45 a. m. the sinking charges were detonated and the crew abandoned ship in one cutter, overcrowded and damaged, which was picked up by the *M. L.-282.* All but three of the crew were taken aboard the motor launch, the cutter was secured to the bow and the launch backed out of the channel at full speed.

Inshore Covering Force.—The *Trident* and *Mansfield,* after parting company with the submarines, covered the western smoke-screen flotilla; the *Whirlwind, Myngs, Velox, Morris, Moorsom* and *Melpomene* covered the eastern one. The *Warwick, Phoebe* and *North Star* cruised in the vicinity of the Mole to protect the Mole assaulting force from torpedo attack. The *North Star* lost her bearings in the smoke and emerged from the smoke-screen to the southeastward of the lighthouse. She fired all of her torpedoes at some vessels moored alongside of the Mole and withdrew. But coming under a heavy fire at point blank range she was quickly disabled and soon in a sinking condition.

The *Phoebe* came to her rescue, circled her repeatedly, threw a smoke-screen around her and took her in tow twice; the first time the tow line was shot away and the second time it parted. Then the *Phoebe* went alongside to tow from that position, but as the *North Star* was rapidly settling she had to be abandoned, the former taking off all of her crew.

The flotilla of coastal motor boats after executing its smoke-screen carried out independent attacks on the German vessels within the harbor. *C. M. B.-5* attacked a destroyer which was under way and damaged her with a torpedo which struck below the forward searchlight, putting it out. *C. M. B.-7* fired a torpedo at a destroyer moored to the Mole and struck her under the bridge. *C. M. B.-32A* struck the steamship Brussels with her torpedo. An explosion followed but the result was hidden by smoke.

OSTEND.—The blocking of the Ostend harbor entrance required two attempts, one on April 22-23, which failed, and the other in the early morning of May 10.

First Attack.—The attack on April 22-23 took place simultaneously with the one at Zeebrugge. The monitors and siege guns opened fire at 11.20 p. m. This bombardment was undoubtedly useful as a blind and kept down the fire on the smoke-screen flotilla and the block ships. The smoke-screen was commenced at 11.40 p. m. with good results. However at 11.50 p. m., when the block ships were standing towards Stroom Bank Buoy, the wind suddenly shifted from the northwestward to the southwestward which greatly interfered with the subsequent actions. The smoke-flotilla tried to combat with this change, but was unsuccessful and was subjected to a heavy but ill-directed fire.

At midnight the block ships passed to the northward of Stroom Bank Buoy, where they first came under fire and laid a dead reckoning course for the pier ends, as no marks were visible due to the smoke. This condition also made it necessary for the *Sirius* to keep close station on the *Brilliant* which was leading. When the Ostend piers should have been seen by the *Brilliant* breakers were sighted on her starboard bow and, although the rudder was put hard left, she grounded. The *Sirius,* observing this, put her rudder hard over and reversed full speed. However, as she was badly damaged by shell fire and sinking she did not answer the helm and collided with the port quarter

of the *Brilliant*. Both ships, being practically aground and in a sinking condition, were blown up and sank about 2400 yards east of the canal entrance. Most of both crews were picked up by *M. L.-532*, *M. L.-276* and *M. L.-283*, each of the last two having gone alongside of one of the ships. *C. M. B.-10* later went alongside of the *Sirius* and determined that none of her crew were left aboard. One small party from the *Sirius* left in a pulling boat and were picked up by the light cruiser *Attentive*, 13 miles from Ostend.

At 1.00 a. m. the retirement signal was given for the whole force. The covering force of destroyers cruised in the vicinity until daylight, searching for any of the small craft which might have been in need of assistance.

The failure of this attack was due to the unknown shifting of Stroom Bank Buoy about 2400 yards to the eastward and the fact that the adverse wind had so placed the smoke-screen that all marks, which might have retrieved the error of the buoy's position, were obliterated.

Second Attack.—The *Vindictive* was available for use as a block ship for a new attempt to block Ostend. Work of refitting her was commenced immediately at Dover in order to make the try on the same tide. This work was carried out night and day to completion by the desired date. Two hundred tons of cement were placed in her after magazines and upper bunkers, which was all that her draft would permit. However, the weather conditions were unfavorable and the action had to be postponed for about two weeks when the necessary conjunction of tide and darkness would again occur.

This delay allowed the securing of the old cruiser *Sappho* for a second block ship. She was fitted out in the same manner as the others at Chatham dockyard. The Germans on the other hand had considerably increased their force of destroyers at Zeebrugge.

The plan of attack was in general the same as the previous one except that the bombardment by the monitors, siege guns and airplanes was to be delayed until the approach of the attacking force was discovered. In order to assure the block ships reaching their destination it was arranged to place a million candle-power calcium flare near the entrance, to be used as a "last resort."

The conjunction of tide and darkness and favorable weather conditions in the evening of May 9, 1918, gave the first opportunity since April 23. Accordingly the force was assembled and the various units left for their stations. An off-shore cover-force of the destroyers *Warwick, Whirlwind, Velox* and *Trident,* from Dover, took up a cruising station midway between Zeebrugge and Ostend to prevent interference by the German flotilla from the former place. The block ships, their destroyer covering force and the smoke-screen flotilla assembled at Dunkirk. Under the command of Commodore Hubert Lynes, C. M. G., this force got under way in the early evening of May 9 and stood towards Ostend. Shortly after the *Sappho* left her anchorage in Dunkirk Roads, a man-hole joint in the side of a boiler blew out, reducing her speed to six knots and therefore putting her participation that night out of the question.

By 1.30 a. m., May 10, all the preliminary dispositions were completed and the smoke-screen flotillas of motor launches and coastal motor boats were sent in to commence the screen. At 1.35 a. m. no firing had occurred, but a searchlight lit up and commenced to search. At 1.43 a. m. the prearranged signal was given and a heavy bombardment opened up by the monitors' siege guns and airplanes. One division of monitors ran in close enough so that their secondary batteries could also come into action. About five minutes later the Germans commenced to return this fire.

The smoke screen was well laid in a western and an eastern section with a lane between them. While engaged in this work *C. M. B.-24* and *C. M. B.-30* carried out successful torpedo attacks against the pier ends. *C. M. B.-22* encountered a German torpedo boat who turned on her searchlight and opened fire. The *C. M. B.* attacked her with her only armament—machine guns—with such good effect that she was driven away from the harbor entrance.

At 2 a. m. the Germans opened a heavy fire from light guns and machine guns, apparently concentrating most of their efforts in a barrage across the harbor entrance. The inshore force of destroyers fired star shells over the entrance to light up the pier ends for the *Vindictive* and shelled the shore batteries in order to draw their fire and in which they were somewhat successful.

About the same time the *Vindictive* accompanied by *C. B. M.-23*, *C. B. M.-25* and *C. B. M.-26,* left Stroom Bank Buoy close on the port hand and stood towards the harbor entrance for 13 minutes. At this time the darkness and smoke had reduced visibility to about one and a half cable lengths. As the entrance was not sighted she slowed down to nine knots and altered course to the westward, parallel to the shore. Failing to pick up the pier ends, she counter-marched to starboard. This in turn brought no success so she again altered course 16 points to starboard and gave the signal for "the last resort." *C. M. B.-23* lighted a million candle-power flare close inshore to the westward of the entrance. The smoke and fog, which had then settled down, dimmed the effect of the flare so that while it lighted up the piers for the *Vindictive* the small craft remained ill-defined or invisible to the Germans, except at closest range.

The *Vindictive* then became clearly visible to the shore batteries and she was subjected to a heavy fire. However, she had only 200 yards to go and immediately turned for the entrance. At this point her smoke boxes were lighted. Having passed the pier ends close to the eastern side the ship was given full left rudder and the port engine was backed full speed. However, as the port propeller had been damaged against the Mole at Zeebrugge it had little effect. As soon as the ship stopped swinging the sinking charges were exploded and she quickly sank with her bow close to the eastern pier and lying athwart the channel at an angle of about 25 degrees. It had been intended to ram the western pier so that the tide could have assisted in swinging the ship across the channel, but when the *Vindictive* found the entrance she was so close to the eastern pier that swinging her to starboard would probably have caused her to ground broadside on.

In the meantime the *Vindictive's* other two escorts, *C. M. B.-25* and *C. M. B.-26,* had torpedoed the pier ends and attacked them with machine guns. This mission accomplished, they drew off.

As soon as the block ship began to sink *M. L.-254* and *M. L.-276* stood in the entrance, engaging both piers with their machine guns, and went alongside of her to take off the crew. A thorough search of the ship was made and all of the wounded were brought off. During this operation *M. L.-276* was hit in fifty-five places but kept under way, steering to the westward,

until picked up by the *Prince Eugene.* The *M. L.-254* was severely damaged and, on standing out, missed the inshore covering force and was finally picked up by the *Warwick*, of the offshore covering force, at 3.15 a. m. after firing a distress signal.

When all hands had been taken aboard the destroyer the motor launch was sunk and the division of destroyers stood off. By this time the tide had fallen so low that it was inexpedient to return by the route inside of the shoals by which the approach had been made. So the course was set for a gap in the net defence by the deep-draught route from Ostend to seaward.

Evidently the Germans had mined this route in anticipation of an attack, as the *Warwick* struck a mine at 4.00 a. m., which broke her back just ahead of the superstructure of the after superimposed 4-inch gun and destroyed the after part of the ship. She took a heavy list and seemed to be settling by the stern. The *Velox* went alongside and took off all of the wounded. The *Whirlwind* took her in tow and the *Velox* remained alongside to steer her. The division arrived at Dover at 4.30 p. m. The general retirement was well carried out without further casualties.

Results.—The chief mission, the destruction of the Flanders triangle, was undoubtedly well accomplished. Aerial observation showed that the blocking of the entrance to the Bruges Canal had prisoned, in Bruges, many torpedo and submarine craft whose draft prevented them from making their way out through the smaller canals to Ostend. And it was not until late in the summer after a great deal of dredging that a somewhat perilous and narrow channel was opened past the *Iphigenia.*

The position of the *Vindictive* in the entrance to Ostend Harbor, lying at an angle of 25 degrees to the eastern pier, merely restricted the entrance and a sufficient channel was left between her stern and the western pier to allow the passage of any torpedo or submarine craft. So the destruction of the triangle was due in part to the fact that the Ostend-Bruges leg was in reality a negligible quantity due to the shallowness of the canals.

On the other hand the damage to the base of the triangle was almost insignificant. The over-running of the prearranged position by the *Vindictive* at Zeebrugge prevented any damage being done to the Mole itself by the excellently arranged demolition party. The destruction of the viaduct by the submarine *C-3*

undoubtedly caused considerable inconvenience in the communication between the shore and the seaplane base and the batteries on the Mole. Aerial photographs of the defences show that although the battery emplacements were damaged, none of the guns were struck.

To accomplish this mission the English expended the old submarine *C-3* and the old cruisers *Thetis, Intrepid, Iphigenia, Brilliant, Sirius* and *Vindictive.* In carrying out the attack they lost the destroyer *North Star* and motor launches numbers *110, 254* and *424*. Besides, the destroyer *Warwick* and *M. L.-276* were badly damaged. The damages to the rest of the forces employed were slight.

Although the losses were no greater than those suffered by the English Army in undertakings of equal magnitude, the personnel casualties on April 22-23 were heavy: 176 killed; 412 wounded; and 49 missing, of which it is believed 35 were killed. In comparison the losses on May 10 were slight, but a much smaller force was engaged: 8 killed; 30 wounded; and 11 missing, all believed to have been killed. The total casualties for the whole operation were 184 killed, 442 wounded and 60 missing.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

BRINGING IN THE SHEAVES

By Commander Clarence Nelson Hinkamp, U. S. Navy

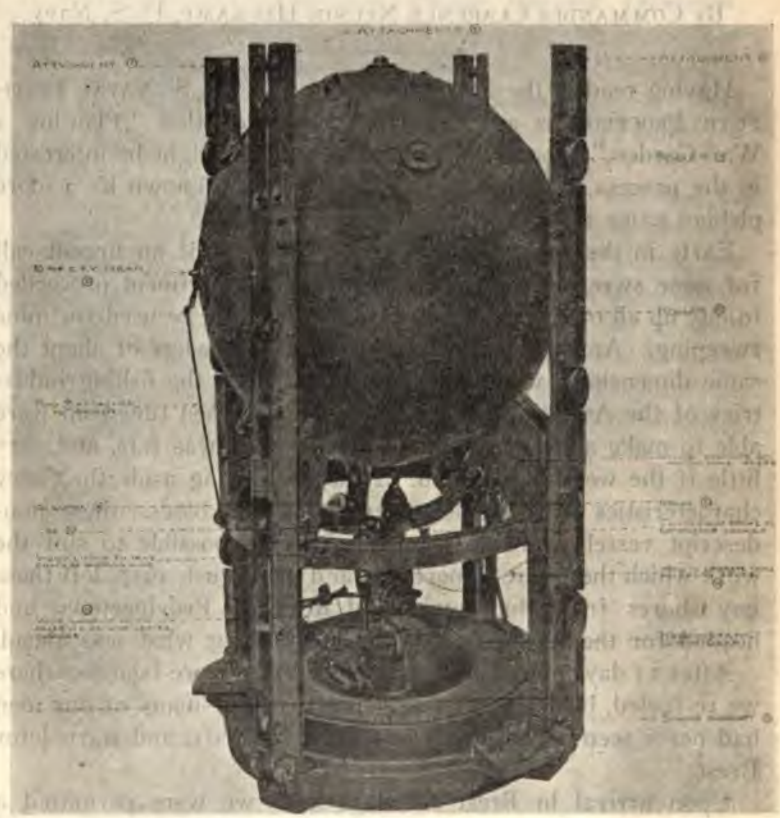
Having read in the March number of the U. S. Naval Institute Proceedings an interesting article entitled "Planting a War Garden," it occurred to me that several might be interested in the process of "Bringing in the Sheaves," known by a more plebian name as "Mine Sweeping."

Early in the summer of 1917 the Allies made an urgent call for mine sweepers, whereupon the Navy Department proceeded to buy up all of the available craft which might be used for mine sweeping. Among the purchases were ten trawlers of about the same dimensions, which had been engaged in the fishing industries of the Atlantic Coast. These vessels when tuned up were able to make about ten knots if the weather was fair, and very little if the weather was bad. However, laying aside the fancy characteristics which mine sweepers should possess, these nondescript vessels were remodeled as far as possible to suit the work which they were to perform, and in August, 1917, left these gay shores from that quaint old town of Provincetown and headed for the Azore Islands, little dreaming what was ahead.

After 11 days of steaming we reached the Azore Islands, where we re-fueled, held a short target practice (for many of our men had never seen a gun, much less heard it fired), and started for Brest.

Upon arrival in Brest six days later we were permitted a short breathing period, after which we were put upon coastal convoy duty. Due to the fact that the vessels were built of wood, and were about as flexible as a spring and not very easy to handle, it was decided, after one vessel sunk off Ushant, to take the trawlers off convoy duty and convert them into mine sweepers, using the French method of dragging. While the vessels were being fitted out at the arsenal in Brest, the officers were sent out on French mine sweepers to learn the game.

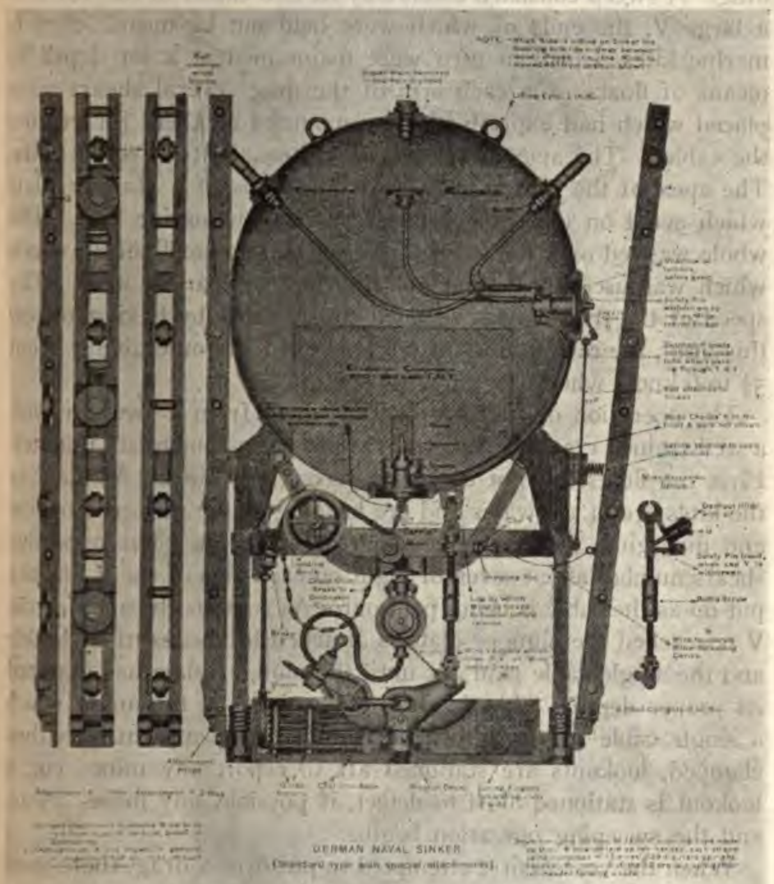
It was my pleasure to spend ten days on a French mine sweeper working on the north coast of France. All convoy routes had been heavily mined so we knew that we would gather some "eggs" We did—a more interesting experience cannot be pictured. It is very pretty to read a description of a fight with a submarine, or a fight with a vessel on the surface, or of sow-



A GERMAN MINE COMPLETE, READY FOR STOWAGE.

ing mines to catch the enemy, but let your imagination run rampant for a few moments and picture an area which is known to be mined, and it is your particular little job to clear the field. It may be that the automatic gear of the German mine did not work, whereupon the mine would float a little too high and the vessel, gently riding on the swells, might, on a downward plunge,

hit one of these small implements of Satan; or it might be that the sweeping gear would foul a mine cable instead of cutting it, and in hauling in the gear the mine might accidentally be hauled up under the ship; or the mine might have been planted with a heavy tide running, and in slack water would be floating with



German Mine Showing Details of Antennæ and Anchor.

the mine cable upright instead of at an angle. All of these conditions might be met and we knew it.

Again, if the vessel was of too deep draft the factor of safety due to the tide would be decreased by just that much. The only factor of safety that there was in the whole mine sweep-

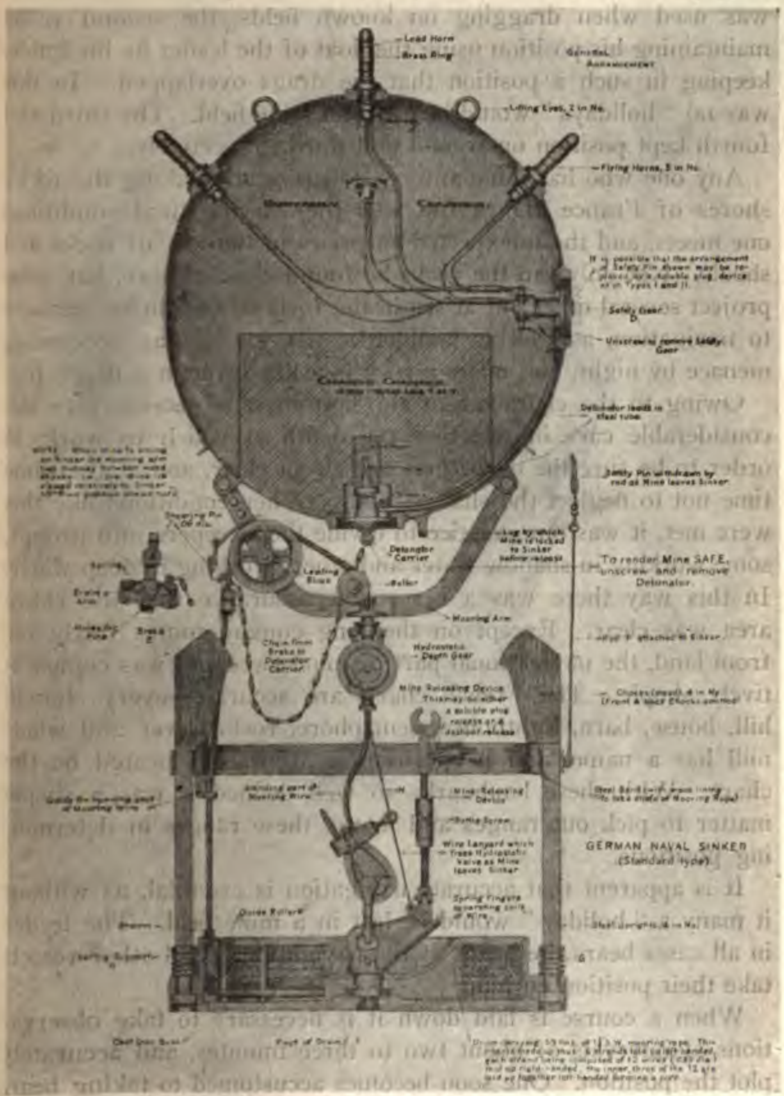
ing operation was that due to the tide, and it sometimes happened when weather conditions were unusual that the tide did not serve in accordance with the rules.

The gear used by the United States vessels in France in mine sweeping is known as the "Ronarc'h drag," or "single ship" drag. A sweep consisted essentially of two cables in the form of a large V, the ends of which were held out by means of submarine kites, which in turn were maintained at a set depth by means of floats. On each arm of the drag several shears were placed which had explosive knives mounted on them for cutting the cables. The apex of the V was connected to a single wire. The apex of the V was held down by means of a plunger plate which acted on the same principle as the submarine kite. The whole was led over the stern of the vessel to a small steam winch which was used for letting out the drag or hauling it in. The speed of the trawler was reduced considerably by having to tow this drag, the revolutions for ten knots in free route giving about 5½ to 6 knots when dragging.

The operation of putting over the drag from a sweeper with a well-trained crew consumes anywhere from four to six minutes. First the floats are put over and second the kites. As soon as the kites are in the water and are heading in the proper direction and diverging, the explosive shears are put on. The explosive shears number about seven or eight on each arm of the V and are put on as the cable is being paid out. As soon as the apex of the V is reached the plunger plate is attached by means of a shackle and the single cable paid out until the plunger plate has assumed its proper depth. This depth is determined by the angle which a single cable makes with a horizontal. The apparatus is then clamped, lookouts are stationed aft to report any mines cut, a lookout is stationed aloft to detect, if possible, any mines ahead, and the sweeping operation begins.

When the vessels first attempted to put over a drag, there were many amusing as well as perplexing difficulties to overcome, but patience and persistence finally won out and the art was mastered.

The formations employed were in general of three kinds: the starboard quarter formation, the port quarter formation and the wedge formation. When sweeping convoy routes on "exploration" sweeping, the wedge formation was generally used. In exploration sweeping the vessels covered a very much wider



GERMAN MINE JUST RELEASED.

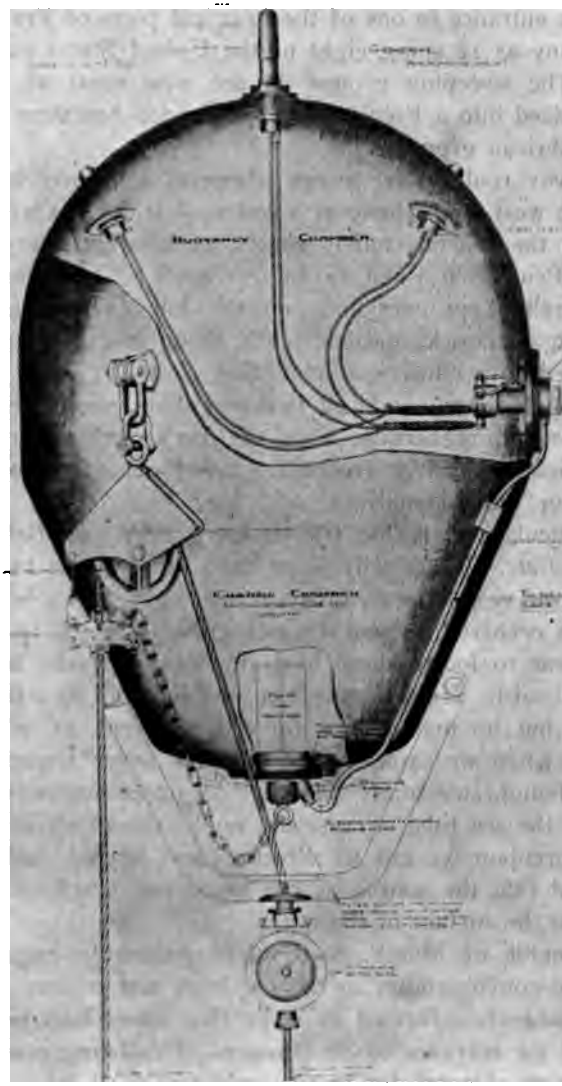
area than when dragging on a known field. Each sweeper could drag a width of about 200 yards. The "quarter" formation was used when dragging on known fields, the second vessel maintaining his position using the float of the leader as his guide, keeping in such a position that the drags overlapped. In this way no "holidays" would be left in a mine field. The third and fourth kept position on second and third, respectively.

Any one who has done any coastal navigation along the rocky shores of France knows full well the varying tidal conditions one meets, and the unexpected surprises in the way of rocks and shoals. Not only can the rocks be found close inshore, but some project several miles out at sea in the form of delightful menaces to navigation, as well as landmarks. A joy by day becomes a menace by night, and many a rock is a life-saver in a dense fog.

Owing to the character of the bottom it is necessary to use considerable care in selecting the depth at which to work, in order to be sure the deep spots are swept clear, and at the same time not to neglect the shallow ones. When conditions like this were met, it was our practice to divide the sweepers into groups, some working in shallow water and others working in deep water. In this way there was a reasonable assurance that the entire area was clear. Except on the long convoy routes fairly far from land, the navigational part of mine sweeping was comparatively simple. The French charts are accurate—every church, hill, house, barn, lighthouse, semaphore, rock, tower and windmill has a name, and its position is accurately located on the chart. With these landmarks so well defined it was a simple matter to pick out ranges and to use these ranges in determining positions.

It is apparent that accurate navigation is essential, as without it many a "holiday" would be left in a mine field. The leader in all cases bears the brunt of the navigation, as all other vessels take their position on him.

When a course is laid down it is necessary to take observations at intervals of about two to three minutes, and accurately plot the position. One soon becomes accustomed to taking bearings, sextant angles, spotting ranges, and laying them down speedily and accurately. By taking readings at short intervals it is simple to detect the set and drift and correct the course in order that the field may be accurately swept.



GERMAN MINE SHOWING DETAILS OF HYDROSTATIC AND MECHANICAL CLAMPS.

The usual number of vessels in one sweeping group when on a mine field is four, although when sweeping one large mine field off the entrance to one of the principal ports of France we used as many as 12 ships, eight of the United States and four French. The sweeping groups on the west coast of France were organized into a French group, a Franco-American group, and an American group.

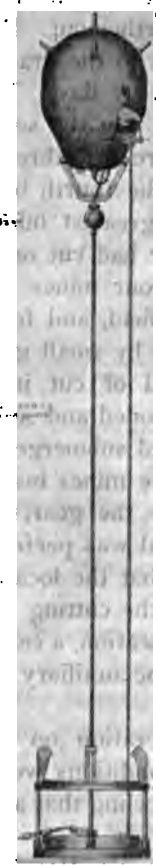
The convoy routes were swept whenever a convoy was due in from the west, and whenever a convoy left for the west, and in addition the coastal convoy routes were swept every other day from Penmarc'h Point to Buoy d'Bœff. This amount of work naturally kept everybody on the job, preventing them from getting homesick, and constantly living in expectation and hopes of getting a mine or a submarine.

If you think the above is all that was done, you have still a few guesses coming, because when the day's work was over on the mine fields, we were frequently called out to patrol areas or " listen in " for submarines.

Our particular submarine friends were *Belle Isle Betsy* and *Penmarc'h Pete*. These wily ships have been known to get as many as three vessels in a convoy in one night, and when these little events occurred, it was our particular little job to go out and endeavor to locate these birds by means of the listening devices on board. Many a ruse was used in order to attract the submarine, but no matter how far out we went, or when we started, or when we came in, the sub was never found. One night we thought we surely had one. A great commotion was heard over the sea tube, a noise not unlike the swish of a propeller—whereupon we got its direction and headed full speed, only to find that the source of our noise was a school of fish playing near the surface of the water.

In the midde of March, 1918, while peacefully engaged in clearing the convoy routes in the northern part of our district, we were suddenly informed by radio that mines had been discovered off the entrance to St. Nazaire. This being one of the principal ports of entry for troops and supplies, it was essential that the channel be cleared at once.

The combined forces of the French and the United States worked on this field. The first mine discovered on the field was picked up by a patrol vessel. The mine was adrift several miles



GERMAN MINE, MOORED.

out. The second mine was discovered several miles from the first by avion. These two mines being so widely separated made the exact location of the mine field difficult, so that it was necessary to use a large number of vessels to explore for the exact location of the field. An area six miles wide and ten miles long was declared dangerous and closed to navigation. This large area had to be completely swept in order to be sure to get the mines. The low-powered vessels worked close inshore while the larger sweepers worked farther out. By figuring very closely on the tides it was possible, with the draft of our vessels, to sweep safely about five hours every day. The first sweep was made and no mines discovered. On the second day of the sweeping operations four mines were cut, three having been cut by one United States vessel and the fourth by a French vessel. Up to that time, three was the greatest number of mines which any one United States sweeper had cut on any one day.

The location of these four mines was such as accurately to determine the line of the field, and for the next week sweeping operations were conducted by small groups of sweepers. In all 12 mines were discovered or cut in that area in one week. Several of them were exploded and several sunk by gun fire and two of them were exploded submerged, the mine-sweeping gear striking the antennæ of the mines instead of cutting the cables. No mines were fouled by the gear, so that the score for the sweepers on that mine field was perfect.

On the particular day that the location of the mine field was accurately determined by the cutting of four mines, we had assisting us in the work of location, a captive balloon, several flying boats, patrol vessels, and the auxiliary vessels which were used to shoot up the mines.

As a spectacle the operation on that day has never been equalled. The weather conditions were ideal and all hands returned to port that night feeling that a good day's work had been accomplished.

For a mechanical device, the Ronarc'h drag, in the hands of amateurs, possesses more peculiarities and queer traits than even the crankiest of cranky automobiles.

The system of signals used was simple. It consisted of signals of formation, signals for putting the drag over, taking it in, and such casualties as one might expect. The signal for cutting the

mine was the tooting of the whistle. When a mine was cut the sweeping division continued on their course as previously planned, the mine being sunk by a small power boat which accompanied the sweeping group. In case no extra vessel was taken along the duty of sinking the mines fell to the lot of the last vessel in formation. He would upon discovering a mine floating, take in his drag and proceed to sink the mine.

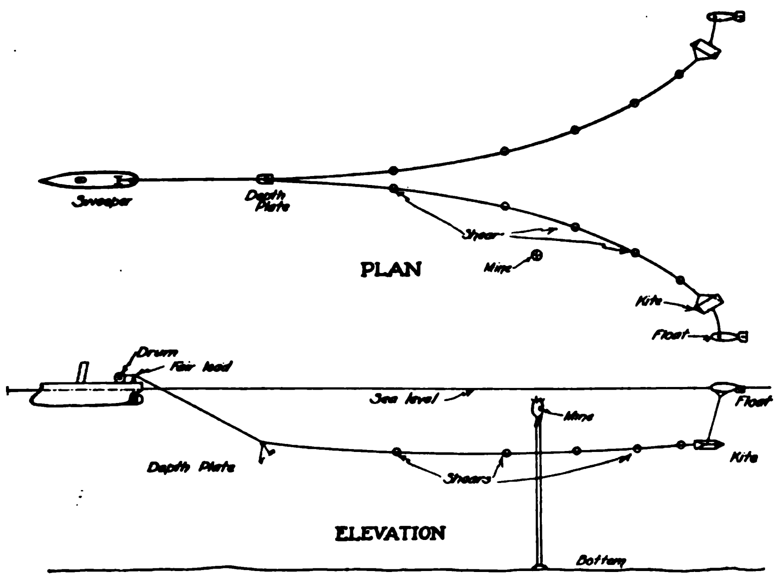


DIAGRAM OF A DIVERGENT SWEEP.

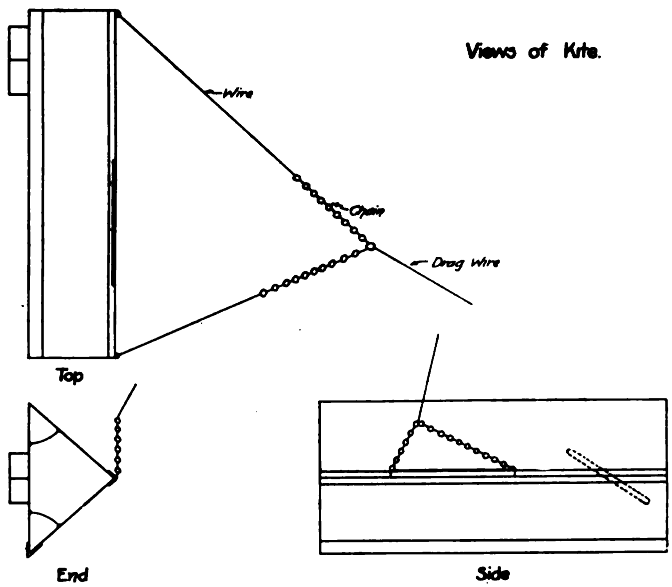
The rules of the Hague Convention required that a mine when it came adrift was to be rendered harmless. The German mines were rigged with a device for extracting the primer when a mine came adrift, but I am firmly convinced that every floating mine was dangerous, because all mines which were captured and examined indicated that the releasing apparatus was not properly attached. Whatever rules there were in regard to mines, the enemy religiously violated them.

It is believed that neutral vessels were engaged in laying mines off the French coast, and it is likewise known that German submarines mostly laid mine fields off the French coast.

The lines of mines were laid usually in the shape of **U's, V's** and **L's,** generally on some well-known navigational range or

within the circles of visibility of more prominent navigational lights along the French coast. Toward the end of the war there was no particular regularity in their methods of laying mines, owing to the fact that their Kultur was either lived down or outgrown to such an extent that the submarine captains dared to exercise a little originality. The mine fields were generally laid by submarines engaged solely in this diabolical occupation.

German submarines engaged in laying mines were very particular not to be seen or discovered prior to laying their mines,

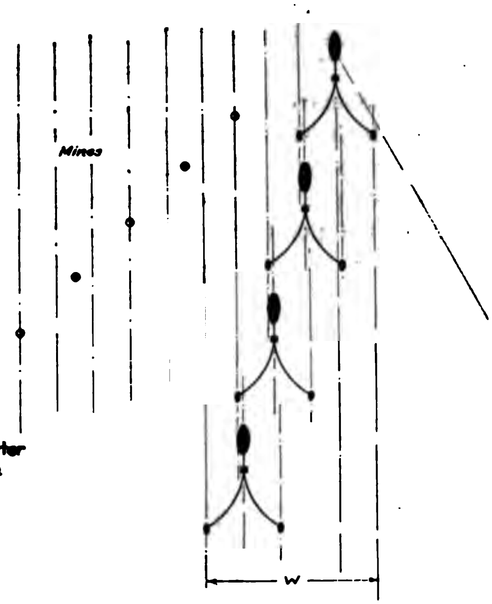


SUBMARINE KITE.

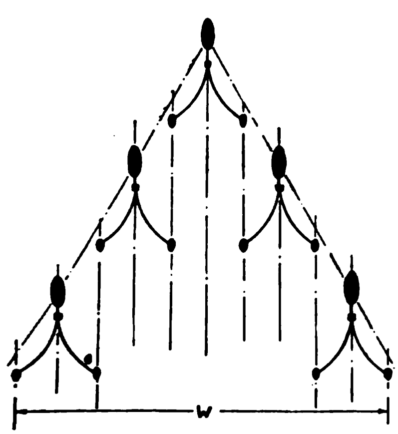
and likewise seldom engaged in attacks on merchant vessels until after the mine fields had been laid, and then generally in a zone far removed from the mine field.

A case is on record of a vessel laying a mine field in the vicinity of St. Nazaire and sinking vessels in the Mediterranean Sea.

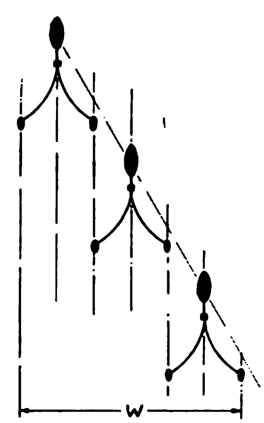
The operation of the German mine is entirely an automatic one. The mine with its anchor is a complete unit and is carried in a torpedo tube from which it can be fired, or is carried in a tunnel in the submarine from which it is released. Mines may be laid either submerged or on the surface, the chances being that the majority of the mines were laid with the vessels travelling



Port Quarter Formation

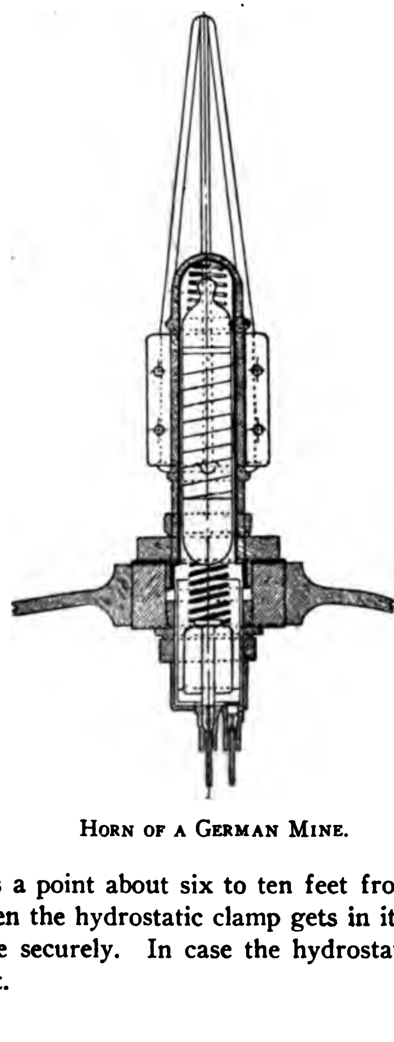


Wedge Formation



Stbd. Quarter Formation

on the surface rather than submerged, although laying them submerged presented no particular difficulties except those of navigation. Mines were generally laid with the submarine traveling at full speed. The mine with its anchor and tracks, when released by the submarine, sinks to the bottom; upon reaching the bottom the hydrostatic pressure works on a small piston which in turn actuates a releasing device. When the mine is released the safety pin of the contact maker is withdrawn and the mine, from that point on, is armed. The mine continuing

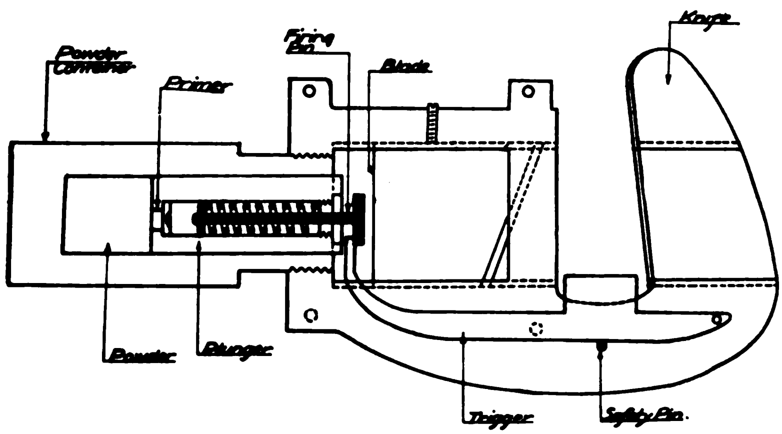


HORN OF A GERMAN MINE.

to rise reaches a point about six to ten feet from the surface of the water, when the hydrostatic clamp gets in its dirty work and holds the mine securely. In case the hydrostatic gear fails the mine will float.

If the part of the cable on which the hydrostatic clamp is working accidentally be cut, the mine will start to rise suddenly, whereupon a mechanical clamp on the other part of the cable engages and holds it fast.

From the above it will be seen that the mine is held to the anchor by two parts of the cable in the form of a single purchase, necessitating—before the mine will float—that both cables be cut. The fact that German mines were moored with a double cable instead of a single made necessary the invention of some form of explosive shears in preference to a mechanical shears,



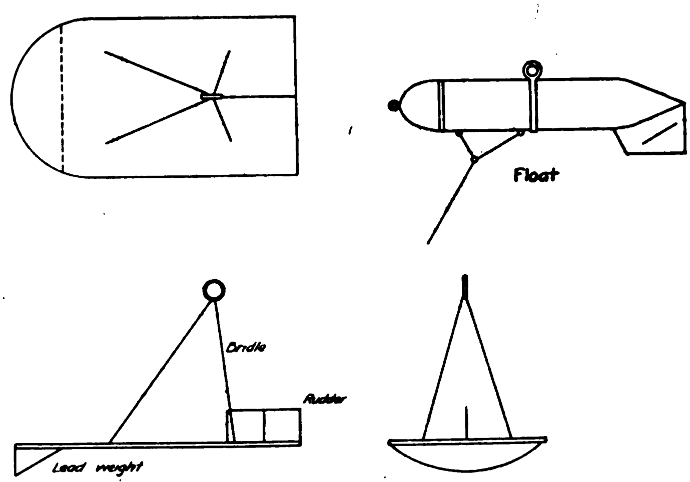
LINE SKETCH OF AN EXPLOSIVE SHEARS.

in order that the chances of getting the mines would be increased by that much.

In the early days of the war when mechanical shears were used there were but four on each arm of the **V**. The mechanical shears could work on but one cable. They were supposed to be automatic in their action, but the device at first was a clumsy affair and very heavy. The explosive shears carry two knives and a hook, so that in case the knives fail the hook is still there to catch the mine cable. It frequently happened before the explosive shears were perfected that they would fail to function and a mine would be dragged along. The anchor being dragged along as well would bounce from rock to rock over the bottom, finally shearing itself, whereupon the mine might float and easily be sunk.

Again, when the shears failed to function a mine with its anchor might be dragged up close under the vessel, in which case the sweeper would head for the nearest sandy beach, constantly keeping the mine in view but well astern.

Upon arrival in a satisfactory anchorage the dragger would then release the sweeping gear at the apex of the **V** and permit the entire apparatus to sink. The floats at the kite end being on the surface would be sufficient to mark the spot where the drag and mine was located. The vessel would then proceed to a safe anchorage and at once send all hands of the crew that could be spared out with several hundred fathoms of line to haul the



DEPTH PLATE AND FLOAT.

mine upon the beach where it could be either examined or destroyed, as desired.

In hauling the mine on the beach the float would first be hauled inshore. Next the kite, and as soon as the mine appeared above the surface of the water the long line would be manned and the mine hauled up on the beach. The antennæ or lead horns are the source of danger, because the bending of one of these horns would cause an electric current to be generated, resulting in the explosion of the mine.

If the mine is to be examined, the procedure should be about as follows: First, pull the contact maker out and insert a safety pin; next, unscrew the plate holding the contact maker. This

would expose the electric wires which can then be cut. As soon as the wires are cut out the mine is safe. Next remove the horns and lastly remove the primer. The mine can then be examined at will.

In case it is desired to explode a mine which has been brought up on the beach, two methods present themselves: One, to endeavor to explode it by rifle fire, shooting at the horns; second, to attach a line to the horns and endeavor to break one. Both methods have been used with success.

It is a remarkable fact that the French have examined a great many mines with very few casualties. To get an idea of the amount of force necessary to bend one of the leaden horns, it may be interesting to note that 20 men had all they could do to break one.

The personnel of the American sweepers consisted of less than 10 per cent of regular officers and less than 40 per cent of regular enlisted men. The ages vary from 18 to 56, the average age being somewhere in the vicinity of 23.

Any one thinking that it is a simple matter to train a ship's company in the gentle art of mine sweeping has many a disappointment ahead of him. However, with persistence and patience much can be accomplished.

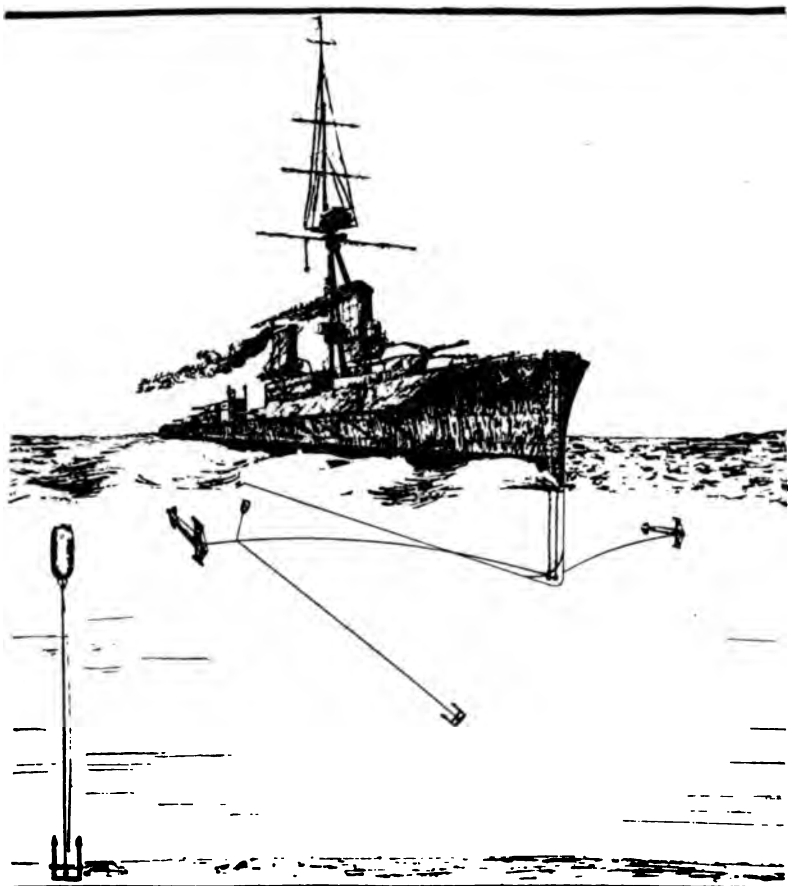


Fig. 1.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PARAVANES

By LIEUTENANT GEORGE L. CATLIN, U. S. N. R. F.

One of the mysterious and most successful new devices used by the Allied Navies in the war with Germany was the Paravane.

This device was invented and developed by Commander C. D. Burney, Royal Navy, for the protection of ships against moored mines. The very nature of this invention, and the manner of its use made its success dependent to a great extent on the maintenance of secrecy in all matters pertaining thereto. Throughout the war, every precaution was taken by the Allied Navies to keep information regarding paravanes confidential. The instructions of the Navy Department prohibited the use of the word "Paravane" over the telephone or in dispatches, and all the correspondence on the subject was kept in confidential files. Up to the time of the armistice, if the enemy had any knowledge of the nature of this device, he had not succeeded in preventing its successful use.

At the time the United States entered the war, the Bureau of Construction and Repair was experimenting with a device somewhat similar to the paravane, in the model basin at the Navy Yard, Washington. In the meantime, reports had been received from the naval attaché, London, that the British Admiralty were fitting their naval vessels with gear for protection against mines. Therefore, soon after we entered the war, the Admiralty was requested to furnish the Navy Department drawings of this new gear, and permission to use it in case it was found valuable. After considerable correspondence by cable, in May 1917, the Navy Department received definite advice from the Admiralty to the effect that the paravane had established itself as a successful device for protecting ships against moored mines. Further experiments at the model basin were accordingly discontinued, and arrangements were made with the British Admiralty

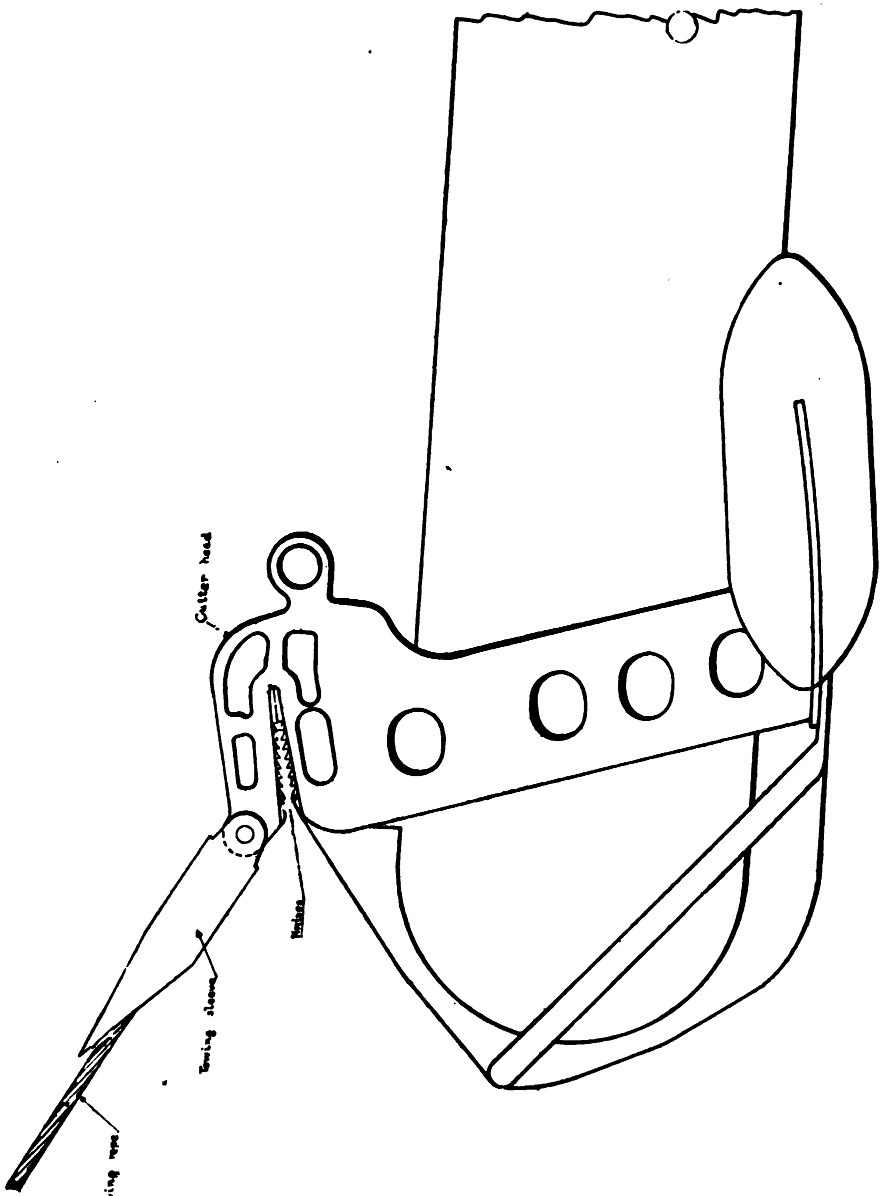


FIG. 2.

for the manufacture of the gear in this country, and for its installation on our naval and merchant vessels.

Principle.—The paravane is in principle an individual mine sweep attached to the bow of the vessel. The general arrangement shown in Fig. 1 is as follows:

From a special fitting attached to the forefoot of the vessel, a torpedo shaped body called a paravane is towed on each side. Vanes and rudders are fitted to this body, which cause it to tow some distance from the side of the ship, and at a fixed depth. A large slightly curved vertical vane, working like a kite, draws the paravane away from the ship. A horizontal rudder with suitable control gear regulates the depth of submergence. The actuating mechanism for controlling the depth will be described further on.

The towing ropes, one for each paravane, attached to the special fitting at the forefoot of the vessel, perform two important functions; the first of these is to tow the paravane; the second is to perform the operation of mine sweeping. As is seen in Fig. 1, these two ropes leading aft and outboard from the stem, form a wedge which encounters the mine moorings and deflects the mine away from the ship toward the paravane. The towing rope is attached to the paravane at what is called the cutter-head, in the jaws of which small saw tooth knives are fitted, as shown in Fig. 2. The mine mooring slides into these jaws, where it is quickly severed, permitting the mine which is buoyant to come to the surface where it can be seen and destroyed.

Three different types of paravanes are used:

Type "M" for merchant ships and other ships of speeds up to 16 knots.

Type "B" for battleships and other vessels of speeds up to 22 knots.

Type "C" for cruisers and other vessels of speeds up to 28 knots.

Depth Control.—All types are about 12 feet long, the spread of the planes being about 7 feet. The size and angle of incidence of the planes vary in the different types, but the principal difference between the type "M" and the other types lies in the depth control mechanism. This control mechanism is somewhat similar to that used in torpedoes. In the "M" type it consists simply of a hydrostatic valve and compression spring,

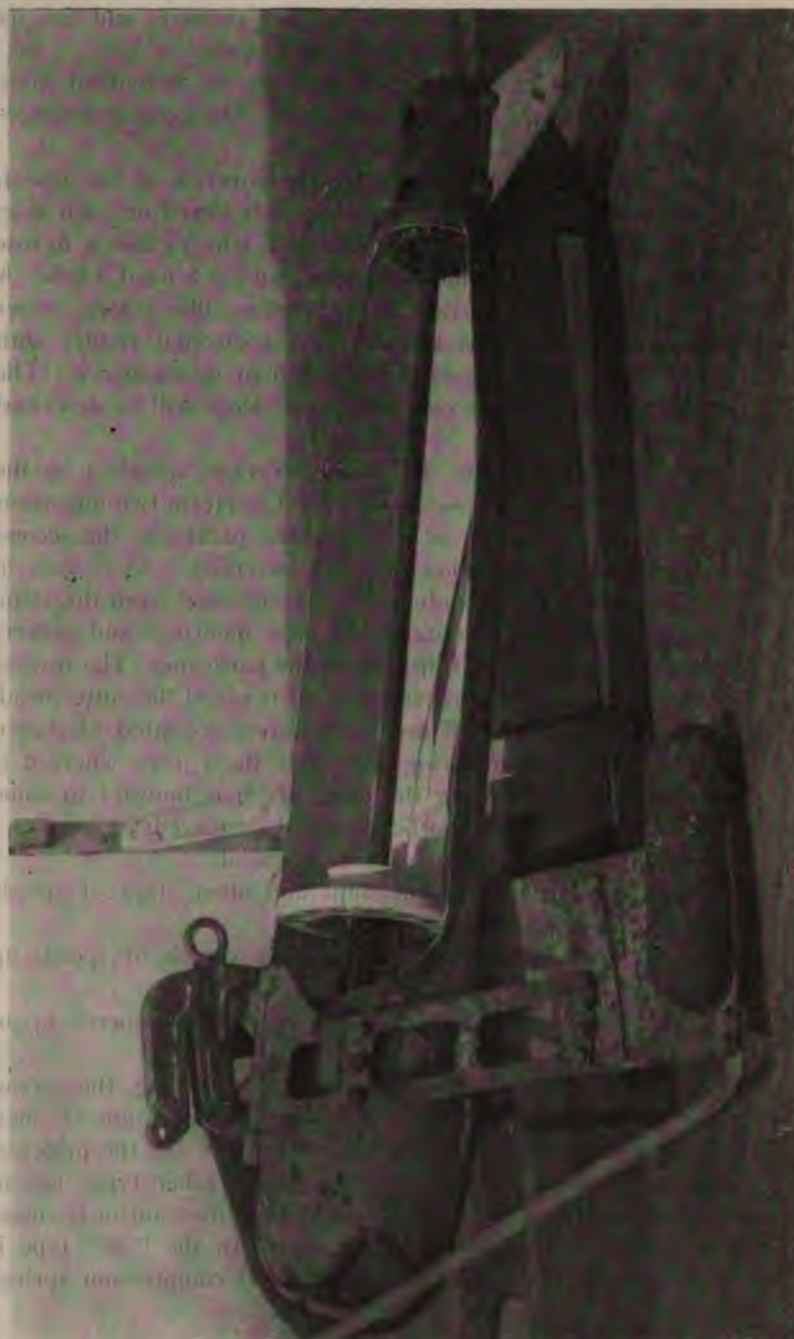


FIG. 3.

located where the tail is attached to the body. The compression spring and hydrostatic valve actuate the horizontal rudder. By regulating the compression spring, the depth at which the hydrostatic valve takes charge is controlled. When the paravane has reached the depth for which the compression spring has been set, the pressure on the valve equalizes the pressure of the spring, resulting in a horizontal rudder. Should the paravane rise above the set depth, the compression spring takes charge, resulting in down rudder and deeper submergence. The opposite action takes place when the paravane has reached too great a depth, causing the hydrostatic valve to take charge.

Oscillator.—Types "B" and "C," designed for higher speed vessels, are fitted with a stabilizer, called the mercury oscillator, Fig. 3, which makes the depth control more sensitive. The hydrostatic valve, being dependent on water pressure for its action, does not respond quickly enough at speeds above 16 knots to prevent large changes in depth above and below the desired running depth. The purpose of the mercury oscillator is to prevent this porpoising action. The oscillator consists of a tube of mercury about 6 feet long, fitted with a valve or diaphragm at each end. Each oscillator contains about 45 pounds of mercury, which exerts a considerable pressure against either diaphragm. A shaft extends from the compression spring in the forward end of the paravane, through the mercury tube to the rudder shaft, and to this main shaft are attached the mercury tube with a valve at either end, and the compression spring directly forward of the forward valve. Just aft of the after valve lies the hydrostatic valve at the point where the tail is attached to the body. It will be noted that the holes in the tail allow the water to come in contact with the hydrostatic valve.

When the paravane is level, the two mercury valves are subjected to the same pressure, and, therefore, no rudder action takes place. The instant the paravane starts to dive, the pressure is increased on the forward valve, resulting in up rudder before the hydrostatic valve has begun to act. In the same way, when the paravane starts to rise, the pressure on the after valve is increased, resulting in down rudder. In this way, the mercury oscillator anticipates the action of the hydrostatic valve, which results in a much more sensitive depth control.

Because of the heavy stress, about 6000 pounds in the case of a vessel moving at a speed of 18 knots, and the severe vibration to which the towing ropes are subjected, the British Admiralty found it necessary to use wire rope of special construction for this purpose. The production of suitable rope in the United States presented some difficulties at first, but these difficulties were satisfactorily overcome by John A. Roebling Sons Company.

The similarity of paravanes to torpedoes and the urgent necessity for early production practically limited the manufacturing field to concerns experienced in the manufacture of torpedoes. The maintenance of secrecy prevented advertising for bids in the usual manner. Two bids were secured, however, the bid of the E. W. Bliss Company, Brooklyn, the principal torpedo manufacturers in this country, submitting the lower bid. A contract for several hundred of each type of paravane was accordingly awarded to this concern.

In the meantime, such information as had been received from England regarding deck fittings and under-water fittings was forwarded to the various navy yards, and the yards were requested to prepare designs for the installation of paravanes on battleships and cruisers.

In October, 1917, the writer having already been assigned to duty in connection with paravanes, under the Bureau of Construction and Repair, was ordered abroad to make a study of the subject, with the view of starting the Bureau's organization for this work.

British Organization.—The British Admiralty at this time had established a separate department at Portsmouth Dockyard, called the paravane department, consisting of a total personnel of over 300, including 71 officers. This organization had charge of the design and installation of the special fittings required in connection with paravanes, the manufacture, inspection and testing of paravanes, and the training of personnel in the use of paravanes. Before the writer returned from this trip, the Admiralty stated that one battleship, five cruisers, and twenty merchant ships had cut German mines with their paravanes. In addition to saving these ships, the cutting of these mines had led to the discovery of mine fields hitherto unknown. In consequence, the Admiralty had ordered all British naval vessels, and

all British merchant ships of 12 feet draft to be equipped with this device as soon as possible.

When the writer returned to the Bureau in January, 1918, it was decided to establish a section called "Protective Devices" under the Maintenance Division of the Bureau, to organize and direct all activities in connection with paravanes. Briefly, the work to be done consisted of the following:

1. Preparing instructions and drawings for fitting paravanes to naval vessels.

2. Preparing instructions and drawings for fitting paravanes to Emergency Fleet Corporation vessels.

3. Selecting and equipping a vessel for testing paravanes.

4. Establishing and equipping a shore station for testing paravanes.

5. Organizing and instructing the testing ship personnel.

6. Preparing a confidential handbook.

7. Selecting and fitting out a PV. instruction ship.

8. Organizing the instruction personnel and laying out a course of instruction.

9. Organizing an inspection force for the inspection of PVs in course of manufacture.

10. Organizing an inspection force to inspect Emergency Fleet vessels being equipped with PVs.

Plans for Naval Vessels.—The various naval vessels were listed, and the scheduled dockings charted so that the installation on each vessel could be anticipated by the Bureau, and the necessary instructions issued in advance to the navy yard at which the vessel was to dock. The system adopted was to have each navy yard prepare a design of the under-water fittings and general arrangement for each vessel in general accordance with the type plans sent out by the Bureau. Blue prints of the plans for each vessel were forwarded to the Bureau for examination and approval, but the navy yards were authorized to proceed with the work in advance of this approval, in order to save delay. The Bureau arranged for the purchase, in quantities, of certain special fittings, common to all naval vessels, and allotted a certain number to each yard to be reserved for paravane gear. Special forms were prepared and sent to the navy yards on which they reported every two weeks the status of the paravane work on each ship. This information as received was entered on a

progress card for each vessel. Also record books were started in connection with paravanes and towing ropes and a policy established of controlling the assignment of paravanes direct from the Bureau. No vessel was allowed to receive paravanes until the Bureau was satisfied that her installation of fittings was complete and in working order.

Plans for Merchant Ships.—The Secretary of the Navy having advised the Emergency Fleet Corporation to equip their vessels with paravanes, requested the Bureau to furnish the Corporation with information as to how they should proceed. Several conferences were held for this purpose, and all the drawings and necessary directions were prepared and furnished to the Fleet Corporation.

In this connection, the use of the word "otter" should be explained. The British Admiralty, at the time the fitting of British merchant ships was started, decided that it would be inadvisable to use the technical word paravane in the merchant marine, and chose the word "otter," to be used as the name of the device in connection with merchant ships. As merchant ships usually use type "M" paravanes, these were commonly called otters, while the "B" and "C" types were called PVs. This policy was followed out rigidly in the British Paravane organization, in fact very few captains of merchant ships ever heard of the word paravane, always referring to the device by the name of "otter," or "otter gear."

In accordance with this policy, the United States Navy has used the words "otter," and "otter gear" in connection with merchant ships, and in naval work the abbreviation PV.

The Fleet Corporation, therefore, under advice of the Navy Department, organized an otter gear department to take charge of the fitting of their vessels. The Bureau, at the same time, arranged for the purchase of an additional supply of otters, towing-ropes and inhaul-ropes to be used in the equipment of the Emergency Fleet Corporation ships.

Selection of Testing Ship.—Although torpedo boats were used by the British Navy for paravane testing vessels, it was believed by the Bureau, that some fast yacht might do the work, and the U. S. S. *Winchester* (Fig. 4), a converted yacht of 30 knots speed, was assigned to this work and ordered to the Norfolk Navy Yard, where she was fitted with the necessary gear.

Shore Testing Station.—At the same time, a location for a testing station was found at Yorktown, Va., where the necessary deep water, available dock, and desirable secrecy were combined. A layout for a railroad, derricks, shop and other equipment on the dock were designed, and arrangements made with the Bureau of Yards and Docks to have the work on this equipment started at once.

Purpose and Operation of Testing.—As the *Winchester* was being fitted out, her commanding officer, Lieutenant W. I. Frost, U. S. N. R. F., was given instructions in the operation of testing, and the complement of the ship was increased to carry on this work.

FIG. 4.—U. S. S. *Winchester* S. P. 156, Towing 22-Knot Otters.

The purpose and method of testing will now be briefly described.

As previously stated, paravanes contain a mechanism for controlling the depth at which they travel. British experience had proved that even the most careful shop inspection of a paravane would not determine whether it would run smoothly at its proper depth or not. It was, therefore, necessary to test each paravane by towing it in the water under practically the same conditions under which the paravane would be used. The only difference in these conditions is the point from which paravanes are towed. In service, they are towed from the forefoot of the vessel, while in testing they are towed from the after deck.

A starboard and port paravane are tested at the same time. Paravanes are manufactured port and starboard, the principal difference being the position of the rudder and also the weight and float on the ends of the plane. The weight is always on the lower end and the float on the upper end of the plane when running. The object of the weight is to cause the plane on the paravane to lie in a nearly vertical position when at rest on the surface so that when the ship starts to pull, it will at once start out from the side of the ship. The rudder, by having up helm, will cause the paravane to submerge at the same time.

FIG. 5.—U. S. S. *Winchester* S. P. 156, View from Paravane Inspector's Observation Post, Towing 22-Knot Otters.

Fig. 5 shows the two paravane towing ropes leading from the stern of the testing ship *Winchester*. By measuring the angle at which each towing rope cuts the surface of the water, the depth and variation in depth of the paravane are determined.

The freeboard of the vessel at the stern forms the base of a right angle triangle, one side of which is the surface of the water. The towing rope is the hypothenuse. Fathom and half fathom marks are attached to the towing rope so that the distance on each rope from the chocks to the water may be easily determined by the eye of the observer. The base and hypothenuse being known, the angle required is figured. A certain correction is applied to

the starboard and a different correction is applied to the port rope for the reason that, due to the twisting action of the water on the wire rope, the starboard rope hogs and the port rope sags, as will be noticed in the photograph.

Each paravane is tested at the maximum speed for which it is to be used in service. Type " M " paravanes are tested at 16 knots; type " B " at 22 knots; type " C " at 25 to 28 knots.

The operation of testing is carried out as follows:

The paravanes are inspected carefully at the testing station on the dock and set to run at 20 feet depth. They are then put overboard and towed out to the testing ship by launches, a port and starboard paravane being delivered at the same time. The testing ship proceeds immediately on the testing course, increasing her speed gradually to the maximum necessary for the type under test, and holding that speed for a full three minutes. If a paravane oscillates more than 5 feet above or below the depth for which it is set, it is not passed by the inspector. At the end of the test the ship is stopped and the paravanes are hauled in and made fast on either side of the ship, close inboard. The ship then returns to the station, lets go the two tested paravanes and picks up a fresh pair from the launches. An inspection slip, showing the record of each tested paravane is delivered to the launch with the paravane so that the record of each paravane is returned with it to the testing station. Under ordinary conditions the testing ship tests a pair of paravanes every 20 minutes.

When a paravane has passed test and is ready for service, a history sheet for that paravane is started. On this sheet is recorded the serial number of the PV. and the adjustments made by the testing station to make it run properly. The history sheet follows the PV. wherever it is shipped. Each transfer and each adjustment of rudder is recorded on this sheet.

Each paravane when shipped from the testing station is set to run at a depth of 20 feet. Instructions are given for each ship to reset her paravanes to run at a depth of 5 feet below her own draft. Vessels drawing over 30 feet, however, are instructed to set their paravanes to run at a depth of 35 feet.

Confidential Handbook.—As it was considered necessary that each vessel being fitted with paravanes should have a book containing full information as to theory, construction, maintenance and operation of paravanes, the Bureau proceeded to compile and

published a confidential handbook called the "PV. Handbook" for the use of naval officers. A copy was forwarded to the commanding officer of each battleship, cruiser and transport, the Bureau requiring a signed receipt for each. At the same time, another handbook called the "Otter Gear Handbook" was compiled, containing information necessary for merchant ship captains, and copies of this book were furnished to the Emergency Fleet Corporation for distribution to their vessels.

Selection and Equipment of Instruction Ship.—As it was necessary to have an instruction ship to train merchant ship captains, as well as naval officers, the Bureau suggested to the Fleet Corporation that they furnish a vessel for this duty, the navy to operate her and direct the course of instruction. The Corporation accepted this suggestion, and the steamer *Berkshire,* of the Merchants and Miners Line, was offered. As this vessel was not fit for overseas transportation, and yet was of sufficient size to make her a suitable ship to operate paravanes, she was accepted. The Emergency Fleet Corporation commandeered the ship and started at once to install, under the supervision of the Bureau, the necessary gear to make her a paravane instruction ship.

At the same time the Navy Department commandeered a small gasoline oyster boat called the *Bivalve,* and fitted her out as a mine layer to work in connection with the instruction ship.

As shown in Fig. 1, it is necessary that PVs. be towed from the forefoot of the vessel, this being the apex of the wedge formed by the towing ropes. To meet the conditions required by different types of ships, three different devices for towing paravanes were developed. All three of these devices were fitted to the *Berkshire,* so that the captain of any ship could receive instructions on the particular device he would have to operate.

These will now be described:

In Fig. 6 is shown the bow of the *Berkshire* with the three devices attached. All have the same purpose, namely, to carry the forward ends of the towing ropes down to the forefoot of the vessel as close to the base line as practicable. As the towing ropes have a limited life, each device is constructed so that it can be hoisted or lowered for replacing ropes while the ship is under way.

The first device, used quite generally on battleships, cruisers and transports, is called the clump and chain. This consists of

two chains leading from the deck through chocks on the bow down through holes in the so-called clump or skeg, returning to chocks on the other side of the bow. The towing ropes are attached to a special swivel connection on the chains, and then hauled down close to the hole in the skeg. The towing point is

FIG. 6.—S. S. *Berkshire.*

hauled down on either side by hauling up the chain on the other side of the bow.

The second device is called the boom device, developed for use on merchant ships of speeds under 14 knots. As is seen in the figure, the boom when in its down position reaches practically to the base line. It is prevented from swinging further down than

this point by a clip which engages the stem. To the end of the boom are attached the towing ropes. When not in use, the forward end of the boom is hoisted to an almost vertical position and lashed to the deck at that point. The principal advantage of the boom is that it may be attached to a ship without docking her.

The third and most desirable device is the sliding bar shoe. This consists of a round steel bar bent into "V" shape, at an angle of about 60°, which is lowered to the forefoot from the cathead as shown in the figure. The shoe may be plainly seen in position just above the holes in the skeg. A preventor chain is also attached to the cathead of such length that the shoe cannot slide below the skeg. Two backhauls, one on either side, are used to steady the shoe as it is being lowered or hoisted.

It is not feasible to use the sliding shoe except on ships with practically a straight stem. As it happened, the Emergency Fleet Corporation's ships under construction were designed with a straight stem and most of them required only a small stem extension or skeg to extend the straight stem down to the keel line to permit of the use of the sliding shoe.

The great advantage of the sliding shoe over the clump and chain is the fact that there are no chains in the water to retard the speed of the vessel, except when the paravanes are being used. Even then there is only one chain for the shoe as against four in the case of the clump and chain.

In connection with the operation of paravanes there are also required suitable davits or derrick booms of sufficient strength to take a four ton load. These are used in launching and picking up paravanes. Winches of reasonable speed and power are also necessary, as well as certain special fittings which will be described later on.

Organization and Operation of Instruction Course.—When the arrangements were being made to organize the instruction force, including the operation of the *Berkshire*, a difficult situation arose in regard to a commanding officer qualified to operate paravanes and instruct personnel. At that time no American naval officer, outside of the Bureau's representative, had had sufficient experience with paravanes to enable him to conduct the instruction course, including the operation of the paravanes. However, one American ship, the *New York*, of the American

Line, had been fitted with paravanes in Liverpool some months previous, and by special arangement with the Bureau of Navigation, her chief officer, Lieutenant H. R. Lewis, N. A. R., was called into active service temporarily for this duty. Under his instruction, Lieutenant C. C. Jones, the former commanding officer of the *Berkshire,* qualified for the practical operation of the paravane gear in about a month, and at the same time a reserve officer, Lieutenant W. W. Nutting, U. S. N. R. F., studied the theoretical side of paravanes, and was very soon able to conduct the lecture on paravanes on the instruction ship.

A lecture room was fitted up on the *Berkshire,* and a moving picture machine was installed for the purpose of exhibiting three moving picture films showing the manufacture, testing and operation of paravanes. These confidential films, taken by Vickers Limited in England, by arrangement with the Admiralty, were secured by the Bureau through the naval attaché at London.

The daily course of instruction consisted of a lecture on paravanes, exhibition of moving picture films, and instructions in setting paravanes for depth. Then the class proceeded to the deck where the operation of the three different types of towing devices was conducted and explained. Finally, the paravanes were launched and the vessel bore down on two mines previously laid by the mine layer *Bivalve,* which were promptly cut with the paravanes. The vessel was then headed for her base, the paravanes were picked up and the towing points hoisted up by whatever device the *Berkshire* was using at the time. Also any part of the operation not clear to any of the class was repeated.

The description of the operation of paravane gear will not be given in detail, for the reason that actual instruction on a ship is necessary before the gear can be successfully handled. There are four separate parts in the operation: First, lowering the towing points to the forefoot; second, launching the paravanes; third, picking up the paravanes; fourth, hoisting up the towing points. The lowering and hoisting of the towing points have already been briefly described in connection with Fig. 6.

The launching is the difficult operation, as it is always desirable to launch paravanes with the least possible interference with the speed of the vessel. The important factor in launching is the control of the slack in the towing rope. Before launching, the towing rope is led from the forefoot to an easing out hook at

the rail, about 75 feet from the stem, thence to a carpenter's stopper and thence to the paravane on deck. The carpenter's stopper is a special clamp which grips the towing rope without damage to the rope, its purpose being to prevent too much slack from being dragged forward by the pull of the water on the towing rope. The paravane is hoisted by the inhaul rope from the deck, and swung outboard ready to lower into the water. The carpenter's stopper is then released. Then the paravane is lowered to the water and the inhaul rope slacked off very fast, the paravane then towing from the easing out hook at the rail. When the paravane is seen to be running steadily, the easing-out hook is slacked off gradually until it reaches the water's edge. At this point the easing out hook, a specially constructed releasing hook, is tripped, and the paravane then tows direct from the forefoot in its proper position.

The method of launching used on merchant ships requires a vessel to reduce her speed to about 7 knots to get her paravanes safely into the water. The reason for this is the position of the planes of the paravane when they strike the water. The inhaul rope referred to above is attached to an eye back of the cutter-head, and when lowered by this eye the planes of the paravane are practically parallel with the water. As they strike the water in this position, quite often the force of the water will turn the paravane in toward the ship instead of away from it. When this occurs, it is necessary to hoist the paravane out of the water and launch it again.

To obviate this trouble, naval vessels are usually fitted with a special pendant and releasing hook for dropping paravanes in the water. This hook is attached to an eye on the paravane near the center of gravity, but so located as to give the paravane just the right tilt as it enters the water. By this method, the force of the water always catches the right side of the planes and the paravane immediately proceeds down towards its proper position. Naval vessels with this gear are able to launch their paravanes at a speed of 12 knots.

On American ships, picking up paravanes is a comparatively simple operation, but requires that the speed of the ship be reduced to about 7 knots. Even at this speed, the operation puts a severe strain on the winch and derrick with which the paravane is hoisted. The inhaul rope leading over the same derrick

by which the paravane is launched, is hoisted slowly until the paravane reaches the surface of the water. At this point the speed of the winch is increased, so that the paravane is hoisted quickly up to the head of the derrick. British naval vessels, however, do not use an inhaul rope and, therefore, have to heave up the towing points first, then under-run the towing rope with a line attached to the derrick. By this line, the paravane is tripped clear of the water, after which another line is hooked on to the paravane for hoisting it on board. This method requires that the derrick from which the paravane is tripped be placed at a definite distance from the stem of the ship.

When the *Berkshire* was ready for operation, a base for her was established at City Island, near Pelham Bay Camp. This location brought her within easy reach of New York City, and also gave her a deep water course in which to operate. The schedule followed was to send the *Bivalve* out into Long Island Sound, some time ahead of the *Berkshire,* to lay the two mines. The *Berkshire* followed slowly, and by the time the lecture had been completed, and the operation of launching paravanes had been exhibited, she would reach the mines and cut them.

The otter gear instruction office was established in the office of the superintending constructor, New York City, to which all officers and men ordered to take the instruction course were required to report for identification and vise of orders before they were allowed to go aboard the *Berkshire.* Each man was also required to sign a register on board the *Berkshire.*

Inspection of Manufacture.—As the information secured abroad showed that the greatest care must be taken in the manufacture and inspection of paravanes, an inspection force was organized with headquarters at the superintending constructor's office, New York City. Several inspectors were assigned to the E. W. Bliss Works, and several were sent to the principal subcontractor, the Bossert Corporation, Utica, New York. This inspection force not only had to watch the detailed manufacturing with great care, but it developed that due to the great rush of government business of all kinds, the matter of priorities had to be carefully followed up by the inspectors to prevent delay in the shipment and delivery of raw materials to the contractor. To the credit of the inspection force, it should be stated that the first paravanes of each type manufactured in this country passed

the service test on the first run, and the percentage of failures was very small compared to the percentage of failures of British paravanes tested in this country.

Lieutenant Joseph F. Edwards, U. S. N. R. F., was placed in charge of this organization, and most of the credit should be given to him. He worked faithfully, and with unceasing activity up to the time of his sudden death from pneumonia following influenza on October 13, 1918. As an example of his devotion to duty, up to the end he continued to direct the work from his death bed, and finally when he became delirious he continued to talk of paravanes.

Inspection of Merchant Ship Installations.—As previously stated, the fitting of the emergency fleet vessels with otter gear was started under the advice of and carried on under the supervision of the Navy Department. The Bureau, therefore, organized an inspection force to inspect otter gear on Emergency Fleet Corporation vessels, during the construction and after completion, to be sure the gear was properly installed and in workable order. The chief inspector was established in the office of the superintending constructor, and inspectors were stationed at Norfolk, Philadelphia and Cleveland. A detailed report on each inspection was forwarded direct to the Bureau.

The entire paravane organization, under the direction of the Bureau, including personnel on the testing ship and instruction ship, contained 27 officers, and 231 men.

New Launching Hook.—The daily operation of the instruction ship gave an opportunity for making experiments in launching paravanes. The method in use by merchant ships, already described, required a ship to slow down to 7 knots to launch her otters, making her at the time an easy target for submarines. This was due to the fact that the plane being in horizontal position would often catch the force of the water on the wrong side and drive the paravane into the ship's side. Fig. 7 shows the paravane being launched according to this method as established by the British practice. It will be noted that the plane in this picture is practically horizontal.

The Bureau by experiments developed a launching hook attached to the body of the PV. through which the inhaul rope is led, giving a tilt to the plane, as shown in Fig. 8. This hook is so designed that it holds the inhaul rope firmly when under

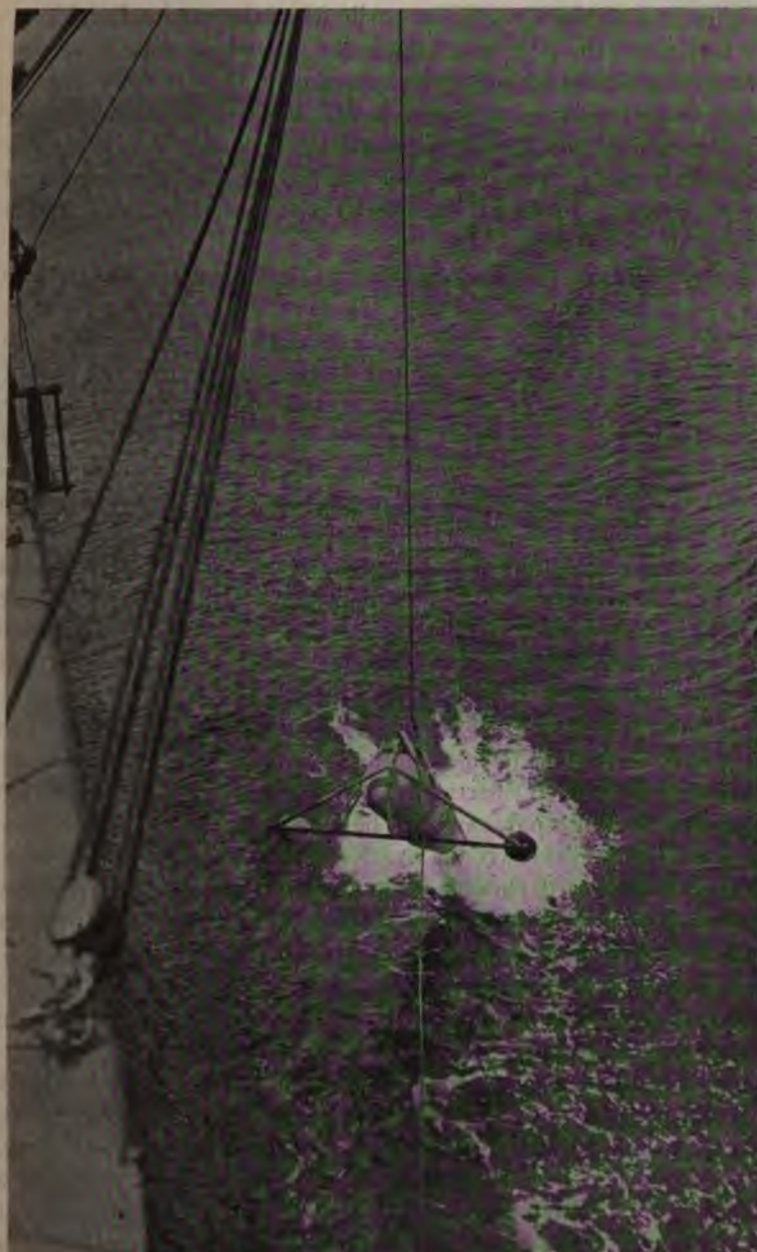


FIG. 7.

tension, but allows it to slip out easily when the tension is released. In fact, when the PV. enters the water, the inhaul rope is washed out by the action of the water allowing it then to lead directly from the eye, back of the cutter-head. It developed that by using this launching hook any vessel could safely launch her paravanes at 12-knot speed. When this fact was proved, the Bureau ordered these launching hooks attached to all paravanes in service, and in course of manufacture.

Alarm Device.—Another device was developed for the purpose of giving an alarm on the bridge whenever a paravane encounters a mine, or any other obstruction. This device was connected with the inhaul rope, and was operated by the variation in the pull of this rope. Whenever a paravane cuts a mine, the pull on the inhaul rope is considerably reduced for a few seconds. This decrease in strain is registered on the bridge, so that when a paravane cuts a mine an alarm bell rings, and if on the port side a red light, and if on the starboard side a green light shows on the indicator. As undoubtedly a great many mines have been cut at night without any evidence, it is believed that this device would have proved to be of considerable value. If the war had continued, it was intended to equip a number of vessels with this alarm.

U. S. Battleship Cuts a Mine.—On September 7, 1918, an event occurred which justified in itself the entire expense incurred by the Navy Department and Emergency Fleet Corporation in connection with paravanes. The U. S. S. *South Carolina*, proceeding from Yorktown, Va., to New York, cut a German mine with her starboard paravane about 6 miles off the New Jersey coast. The mine came to the surface off the starboard quarter of the vessel, and was seen not only by the officers on the U. S. S. *South Carolina*, but by the officers on watch on the U. S. S. *New Hampshire*. The latter vessel, following the *South Carolina* in column, sheered out to avoid the mine on the surface.

The *South Carolina* would undoubtedly have been severely damaged, if not sunk, if she had not been protected by paravanes.

In the same month the U. S. S. *Quinnebaug* of the mine force, while operating in the North Sea loaded with mines, deflected a floating mine with her port paravane. This mine had been cut or had broken loose from its moorings, but apparently had a mooring line attached to it. This mooring line encountered the

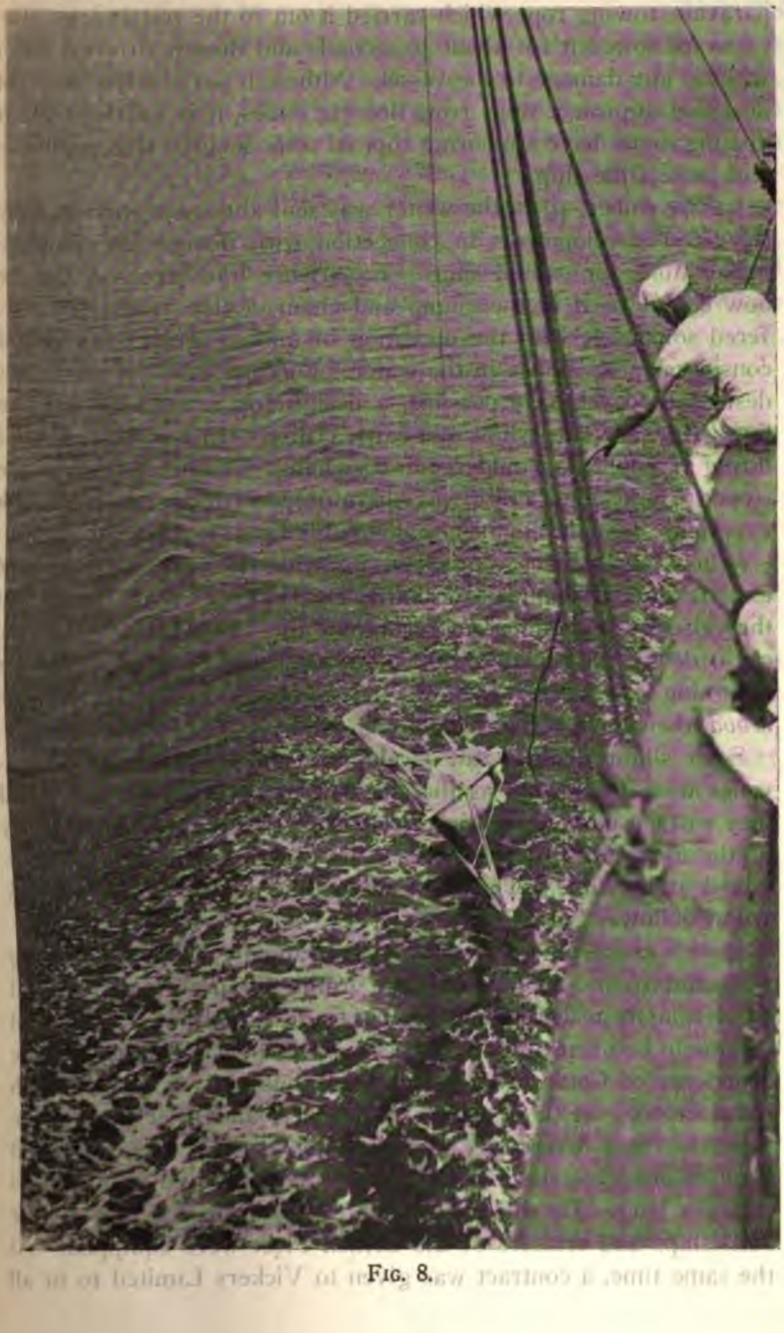


FIG. 8.

paravane towing rope which carried it out to the paravane. The paravane towed it for about 30 seconds and then it floated astern without any damage to the vessel. Although paravanes were not designed to protect ships from floating mines, it is evident that if floating mines have a mooring rope of some length, the paravanes will protect the ship.

In November, 1918, the writer was sent abroad again to study the latest developments in connection with design of paravane installations for capital ships. Experience had proved that the bow chains used in the clump and chain device not only interfered somewhat with the operation of anchor gear, but offered considerable resistance in the water. For this reason the bureau desired to develop, if possible, a design for a sliding bar shoe fitting for new battleships and battle cruisers under design. This fitting if adopted, would require a change in the design of the stem of these ships, and it was, therefore, decided that the British experience and developments along this line should be studied.

When this subject was taken up with the British paravane experts at Portsmouth Dockyard, England, it was found that they also were planning to discontinue the use of the clump and chain device on capital ships. They were, in fact, at the time designing a new type of sliding shoe to be tried out on H. M. S. *Hood,* their most recent capital ship.

Some slight changes and developments in the design of paravanes were found, but as the changes adopted were not radical they will not be described in this article. Also a complete history of the experience of the British Navy with paravanes was obtained at his time. The most interesting items in this history are as follows:

British History.—Paravanes were gradually developed during 1915 and 1916. At one time the Admiralty practically stopped the development work, believing paravanes could not be perfected in time to be of any value during the present war. The absolute confidence of Commander Burney, and one or two other British naval officers, in the value of the device, and their persistence with this idea, overcame the objections of the Admiralty and resulted in successful paravanes being manufactured in quantities early in 1917. By the summer of that year, practically all the battleships and cruisers of the British Fleet were equipped. At the same time, a contract was given to Vickers Limited to fit all

British merchant ships with paravanes as soon as possible. To accomplish this, Vickers formed an organization in each important port so that the vessels could be fitted as they became available. They also sent an organization to this country to equip British ships in American ports. Up to December 21, 1918, 2766 British merchant ships had been fitted with paravanes. The total estimated expense of the Admiralty in connection with protective paravanes was about nine and one-half million pounds sterling, of which three and one-half millions were expended on naval vessels, and six million on merchant ships. The number of mines cut by naval or merchant vessels reported up to December 21, 1918, was 72, subdivided as follows:

37 cut by light cruisers.
3 " " armed merchant cruisers.
1 " " a mine sweeper.
1 " " a cruiser.
1 " " a battle cruiser.
1 " " a battleship.
25 " " merchant ships.
3 " " a hospital ship.

In addition to these, 12 naval vessels and 12 merchant ships reported mines probably cut but as the evidence is not absolutely complete these are not included in the above list.

It is probably unnecessary to state that the British Admiralty considered the paravane of inestimable value. Naval critics have calculated that British ships to the value of $500,000,000 were saved by paravanes. In time of war, however, ships cannot be measured by money, as the time involved in the replacement of a lost ship is the serious factor.

Reward to Inventor.—It is understood that the inventor of this remarkable device will receive thirty thousand pounds sterling as a gratuitous award from the Admiralty for the use of his invention on naval vessels. He will also probably receive twice that amount from Vickers Limited in royalties on paravanes used on merchant ships. His services were also recognized by the Admiralty in promoting him from lieutenant to commander in the Royal Navy, and in conferring on him the Order of the Cross of St. Michael and St. George.

PROOF OF A SEVEN-INCH GUN AT MAXIMUM ANGLE OF ELEVATION, 40°, AT NEW LOWER STATION OF NAVAL PROVING GROUND.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

HOW THE NAVY DESIGNED AND BUILT THE WORLD'S HEAVIEST FIELD PIECE

THE BUREAU OF ORDNANCE BRINGS OUT AN ENTIRELY NOVEL TYPE OF MOUNT FOR A SEVEN-INCH NAVY GUN FOR THE U. S. MARINES

By Ensign C. L. McCrea, U. S. N. R. F.

Battleships of the *Connecticut* class when built were provided with a secondary battery of 7-inch 45-caliber guns mounted between decks. These seven-inch guns gave excellent service and were a good selection for the work that was expected of them, but had not been popular in the navy because they were too heavy for broadside work and too light for turret mounting, and a change was made in later battleships to the 5-inch 51-caliber guns, and then to 6-inch 53-caliber guns.

The experiences of torpedoed war vessels demonstrated the danger of having wide gun port openings in the broadside of vessels, such as the mounting of these 7-inch 45-caliber guns required in the *Connecticut* class. A heavy list from under water damage lowered the port sills to water, resulting in an inrush that capsized and sunk vessels that otherwise would have reached port. This being an undeniable fact, taught by bitter experience, the desirability of removing many of these guns and closing the ports when the battleships were assigned to convoy duty was self-evident. Therefore many of these guns were removed and thus became available for service elsewhere.

The seven-inch guns removed may be described about as follows:

The gun with breech mechanism weighs 28,700 pounds, or about 14 tons. It is 45 calibers, 315 inches, or about 26 feet long, and gives a 153-pound shell a muzzle velocity of 2800 feet per second. At a range of 14,000 yards the shell has a remaining velocity of 1250 feet per second, and can penetrate several inches of armor

plate. Its maximum range at an elevation of 40° is in the neighborhood of 24,000 yards.

On board ship, the mount for the gun weighed nearly 30,000 pounds, so that the total weight of the gun and mount was not far from 30 tons. When the gun recoiled after firing, the maximum trunnion pressure exerted was about 195,000 pounds. A hydraulic brake took up the recoil through a distance of 21 inches, and the gun was brought back to battery or firing position in the usual way by means of heavy helical springs contained in spring cylinders attached to the slide in which the gun operated. The mount was designed to allow a maximum elevation of the gun of 15°, which allowed a range of about 14,000 yards.

The guns were too heavy for anti-submarine work on merchant ships, patrol vessels, etc., but for land use they were an excellent weapon. The urgent need of our forces in France for artillery was, of course, known, and a means for placing these guns into action in the war was earnestly sought.

Early application for a number of these guns was made by the U. S. Army, and a number were turned over. The guns thus turned over were mounted by the army on railway cars. Special cars were used for this purpose, built with a drop frame bed so that the entire seven-inch gun and its mount, exactly as it was used on board ship, could be placed on it and yet clear the French tunnel roofs and bridges when in transit, but none of these guns so mounted were sent abroad for service during the war.

This railroad mount was limited in its use by the fact that the elevation limit set by conditions on board ship was still maintained; that is, the gun was still capable of a maximum elevation of but 15° with its corresponding range of 14,000 yards. Further, the heavy trunnion pressures existing on account of the short length of recoil of the gun, while entirely satisfactory on board ship where the structure of the vessel is built to stand them, were troublesome when the mount was placed on a railway car. Strong outriggers and bracing of the car and bed were required when the gun fired at targets at an angle to the line of the track on which the gun car was located.

When considering the best way to place these guns in the war, the Navy Bureau of Ordnance first gave attention to the plan of mounting them on railway cars. They first set to work to increase the permissible angle of elevation from 15° to 30°, feeling that this was the minimum that should be allowed. The designs

were soon completed. They called for the mounting of the guns on a special flat car, the bed of which was not dropped, but which had a heavy under-frame so that no bracing of the car, other than a few light outriggers, would be necessary when the gun fired. This called for the construction of a new mount in which the maximum elevation of 30° was possible, and in which the trunnion pressure was reduced to a value of about 65,000 pounds. In the new mount, the recoil was used to elevate the entire gun up an inclined runway in addition to overcoming the resistance of the hydraulic brake.

Word was received from abroad while these designs for a railway mount were being completed that better use of these seven-inch guns could be made if a suitable field mounting were developed for them, and, as they were navy guns, their operation would then be entrusted to the marines.

The allied armies required, and needed badly, a major caliber field piece of a range of 20,000 yards or so that was thoroughly mobile, and could travel over any country over which a tractor could go, and yet could be transported from place to place without disassembly. All of the large field guns in use by the British and French, as well as many of the smaller and less powerful howitzers, were so made that in order to transport them for even short distances the entire gun and mount had to be taken apart, the pieces loaded on separate trucks or carriages and transported as separate units, and then reassembled before fire could be recommenced. There was no such thing as a really mobile high-powered large caliber field piece that could be transported to the front on a moment's notice, and would arrive there ready to commence fire on the enemy without several hours hard work of preparation.

Rear Admiral Ralph Earle, chief of the Navy Bureau of Ordnance, recognized this need for a really mobile mount, and in a letter written to the Naval Gun Factory early in March, 1918, pointed out that the design and construction of such a mount for the navy seven-inch gun would mark a distinct advance and would fill a great need, and instructed them to start the work of design.

Work on the design of a mobile field mounting for the seven-inch gun was immediately started at the Naval Gun Factory, the date being March 15, 1918.

The Bureau of Ordnance was confronted with a problem which can be outlined about as follows:

A mobile mounting was desired for a seven-inch gun weighing 30,000 pounds—a mount that would allow the gun to be transported as a unit so that no preliminary preparation was necessary before firing. The seven-inch gun was the heaviest and hardest hitting gun for which a mobile field mount of this kind had ever been requested by any nation or army. The mounts were wanted in France before the close of the year 1918—a date less than nine months distant—so the time for design and construction was short.

With these conditions in mind, the gun designers of the Naval Gun Factory proceeded to study existing designs of field artillery that were available.

A brief examination of these designs showed that a wheeled mount for the seven-inch gun was not practicable. The weight of the gun and mount complete would be in the neighborhood of 70,000 pounds, or 35 tons. Assuming a six-foot wheel, and an arc of 25° in contact with the ground at any time, the total bearing surface to carry the load would be about six square feet, giving a ground pressure of about six tons per square foot, or 88 pounds per square inch. This weight was, of course, prohibitive, for the gun when moving over a road would probably leave its path marked by broken roadbed, and further, when the piece left the road and attempted to move over soft ground, there was every reason to believe that it would soon become hopelessly mired. Another doubtful point, also, was whether or not a wheeled mount of the ordinary type would prove satisfactory on firing, as wheeled mounts have a tendency to roll back on firing, and the weight of a large wheeled mount makes accurate aiming a different task.

A wheeled mount was clearly not practicable for the seven-inch gun, so a search was made for something better. At this point the idea of utilizing the principles of the so-called "caterpillar" belt for transporting the mount was suggested. Instead of wheels, it was proposed to use a steel frame with rollers carrying a link belt presenting a large flat surface to the ground. Similar material had been used with success on commercial tractors and on adaptations of them, etc., mounting small pieces of artillery, but never on a gun mount for a major caliber gun.

Yet there appeared no practical objection. Sufficient strength could be given to the construction of the tractor belt so that it would withstand the stresses brought to bear, and preliminary calculations showed a ground contact area of 28 square feet would be obtained giving a bearing pressure of about 18 pounds per square inch, which is about one-half of that exerted by a horse's hoof. Designs were accordingly commenced by the Naval Gun Factory on a mount of this type, to carry the seven-inch guns.

In order to save time in construction, it was hoped that it might be possible to incorporate into the caterpillar mount for the seven-inch gun a number of parts of the mount used on board ship, particularly the gun slide and the recoil and counter-recoil mechanism. It appeared more logical on considering the question, however, to lengthen the recoil of the gun as much as possible, thus reducing the trunnion pressure when firing and in turn the weight of the mount, than to build a heavy mount capable of standing the shock of firing with the short length of recoil set by conditions on board ship. Further, the counter-recoil mechanism of the marine mount was designed to return the gun to battery at elevations up to 15° only. An elevation of 40° was contemplated in the new land mount, making the design of a new counter-recoil mechanism necessary. It was soon found, therefore, that the designers must work from the ground up—every part of the mount had to be newly designed. Only the gun itself, with its breech mechanism and yoke, could be used of the material taken from the battleships.

Work on the designs was rushed at the Naval Gun Factory, and, in spite of the great pressure of other work, progressed rapidly. Preliminary designs were submitted within a fortnight: they called for a mount, the features of which were caterpillar belt wheels, a structural steel carriage, and a gun slide equipped with hydraulic recoil and pneumatic counter-recoil systems. These recoil systems allowed a recoil of 32 inches, which reduced the trunnion pressure from the value of 195,000 pounds in the original navy marine mount, to a value of 120,000 pounds.

Although entirely new, and at least a year ahead of the times, the designs were so carefully worked out and the engineering facts were so strikingly presented that immediate approval was given to the Navy Bureau of Ordnance by the chief of Naval Operations to proceed with the details and construction.

On May 25, the designs were pronounced complete, and, shown on 164 separate drawings, were ready for submission to the bidders.

DETAILED DESIGN OF THE SEVEN-INCH CATERPILLAR MOUNT

THE CATERPILLAR WHEELS

The construction of the caterpillar wheels can best be shown by the photograph.

In itself, the wheel consists of an endless belt of cast steel links, connected by hardened pins, each link carrying a corrugated forged steel plate which makes contact with the ground. The plates overlap when horizontal, so that a continuous surface is presented. Detachable grousers are provided to prevent the tread from slipping when the mount encounters soft ground.

The track links run over two large sprocket wheels and 11 truck and idler wheels as shown, the shafts on which these wheels turn being supported by a steel beam of special design. The sprocket wheels carry but little of the load except when the gun is descending a grade or when the brake is applied to the mount.

For smooth running and reliability, roller bearings are provided in the truck and idler rollers. The ends of the bearing housings are closed by steel plates to prevent the entrance of dirt, sand, etc., when the caterpillar is hauled through mud, sand, and soft earth.

A brake is provided to permit the control of the mount when descending hills, etc., and also to lock the caterpillar in position when the gun is set up for firing. The brake consists of a toggle joint operating on the rim of the sprocket wheel, the tension applied being controlled by an adjustable spring. This brake, although exceedingly simple, has been very satisfactory in operation in controlling the heavy mount on steep grades and in checking any tendency of the mount to move on firing.

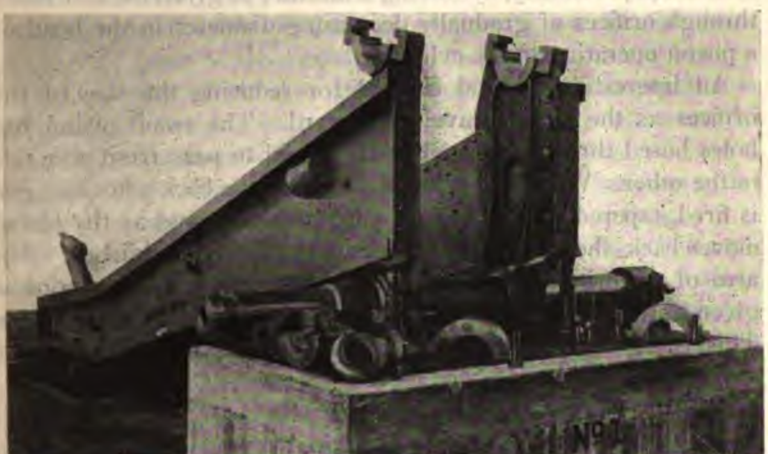
THE AXLE OF THE MOUNT AND THE METHOD OF ATTACHING THE CATERPILLAR WHEELS

The axle is a steel forging, nine inches in diameter with a five-inch central hole. It is supported in the wheel by a hub bracket, which in turn is carried by the structure of the girder on which the sprocket and truck wheels are mounted. This bracket is held by oscillating bearings and is spring supported so

that the caterpillar may adjust itself to any unevenness in the road when the gun is in motion. The springs are taken up by means of holding down screws when the gun is placed in firing position, in order that the mount may keep steady on the point of aim while firing.

THE GUN CARRIAGE

The carriage which supports the gun is a structural steel framework built up of standard steel shapes. It consists essentially of two main side girders cross-braced at each end to form a single unit with a central well into which the gun recoils.



CARRIAGE OF SEVEN-INCH MOUNT ON ASSEMBLING STAND SHOWING TRUNNIONS, AXLE AND A FEW OF THE COMPONENT PARTS.

To permit of accurate aim, a traversing gear is provided at the rear end of the gun carriage. A cast steel plate which rests on the ground is built into the structural work at the rear end of the trail and is held to the trail by clips. A worm shaft operated by ratchet wrenches shifts the trail with reference to the plate and enables the gun to be accurately trained.

The trunnion seats are located at the upper end of the carriage. A cylindrical casting, known as the gun slide, to which the trunnions are attached, carries the gun, according to standard navy practice.

The recoil and counter-recoil mechanisms are attached to the gun slide, operating through pistons attached to the yoke. When

recoiling, the gun runs in and out of the gun slide. Bronze liners are fitted to the inside of the slide to enable this to take place easily.

The trunnions of the gun are mounted sufficiently high so that at maximum angles of elevation only a shallow trench—about one foot in depth—need be dug to allow a clear space for the recoil of the gun.

THE RECOIL SYSTEM

The recoil system consists of a simple hydraulic brake. The energy of recoil is absorbed through a distance of 32 inches, as mentioned previously, by forcing a mixture of glycerine and water through orifices of gradually decreasing diameter in the head of a piston operating in the cylinder.

An interesting method is used for reducing the size of the orifices as the piston travels backward. The recoil piston has holes bored through it to allow the liquid to pass from one side to the other. When the piston starts to move back after the gun is fired, tapered throttling rods enter the holes and as the piston moves back, the size of the orifices is gradually diminished. The area of the orifices is so calculated that a constant retardation is given to the gun, and it is brought to rest at the end of the stroke. This is similar to the method used for checking the recoil of major caliber guns.

THE COUNTER-RECOIL SYSTEM

The seven-inch mount as installed aboard ship, it will be remembered, was capable of an elevation of but 15°, and springs were used to return the gun to firing position after recoil. With the new type of mount, however, spring return could not be made to function satisfactorily.

Pneumatic systems in use abroad were investigated in the search for a satisfactory counter-recoil mechanism for this heavy gun. It was decided after considerable study to use a counter-recoil mechanism of the French type, such as used on the 155 mm. guns, as it was felt that it would prove satisfactory.

In this type of mechanism, when the gun fires, a piston attached to the gun yoke moves backward in an airtight cylinder containing air at a pressure of several hundred pounds per square inch, still further compressing the air. When the gun has reached

the end of its travel in recoil the compressed air, acting upon the piston, brings the gun back into battery.

The only objections to the adoption of this system were the exceedingly close limits to which the manufacturers must work when machining, and the complications in the mechanism itself. This complication of parts was caused by the fact that a floating piston surrounded by liquid is used to prevent escape of high-pressure air. This piston is so arranged that should leakage of the confined air occur, it will serve merely to displace the liquid which surrounds the floating piston. When leakage has occurred to any considerable extent, it can easily be remedied by the use of a small hydraulic pump, which returns the liquid to the space surrounding the floating piston and in turn forces the air back into the air space of the mechanism.

The quantity of air that escapes from this liquid packing is so small that the gun will operate for a long time on an initial charge of compressed air, and when the pressure has fallen to a point where the counter-recoil mechanism will not function satisfactorily, it can easily be recharged by a pump or airflask.

All the parts were arranged in one cylinder in the French design, making the mechanism exceedingly compact. But this fact alone made machining and assembly operations difficult. Combined with the close limits set by the French, it was soon found that it was impossible to adopt the French designs. Accordingly, the designers of the Naval Gun Factory set to work to develop a new design of counter-recoil system, using the pneumatic principle, but adapting it to American methods of manufacture and to American shops.

The product of their work is shown in the photograph. The counter-recoil system, located on top of the gun, has been changed from a single cylinder to a combination of three cylinders, connected at the lower end by a cast bronze head. The piston attached to the yoke operates in the central cylinder. The system of liquid packing has been retained, but has been much simplified. The entire system is made up of shapes and material easily secured, does not call for extremely close machining, and is well adapted to American machining methods.

The elevating gear is a simple combination of a handwheel, worm gear, and rack and pinion that has been found to work out with extreme satisfaction in practice.

The sighting arrangements for the gun consist of a panoramic sight of standard design, fitted to a bracket attached to the gun carriage.

THE CONSTRUCTION OF THE SEVEN-INCH MOUNT

Preliminary designs for the seven-inch mounts were first undertaken on March 15, 1918. After consideration, as described in the preceding part of the article, detail designs were commenced, and on May 25, 1918, these were pronounced complete. One hundred and sixty-four separate drawings were required to show the material.

On May 30, 1918, proposals were sent out calling for bids for the manufacture of material. An initial construction of 20 of these mounts was decided upon. Proposals called for the delivery of the 20 mounts in 120 days.

Although many bids were received, the times of delivery set in most of them were far too long to warrant their consideration. The guns were needed in France, not in 1919 or 1920, but before the end of 1918. On June 18, 1918, therefore, the contract was awarded to the Baldwin Locomotive Works, Philadelphia, who agreed to undertake the manufacture and delivery of the 20 mounts in the time specified, in other words, by October 18, 1918.

Work moved rapidly forward from the first day. Material began to arrive at the Baldwin Works within a few days after the contract had been awarded and orders for material placed.

PERSONNEL TO OPERATE THE MOUNTS

While fabrication was going forward at the Baldwin Works, the marine corps organized a regiment of men to operate the guns. These men were placed in camp at Indian Head, Md. They were completely outfitted by the Bureau of Ordnance with motor trucks, supply and repair equipment, telephone equipment, etc., necessary for the operation of the batteries.

The first two mounts, complete and ready to fire, were shipped from the Baldwin Works on September 26, 1918, just 100 days from the date of the contract, and arrived at the Washington Navy Yard on September 30. They were sent to the Naval Proving Ground at Indian Head for road tests and proof firing.

Two three-ton trucks were found capable of hauling the mounts on arrival at Washington Navy Yard. The mounts, weighing

76,000 pounds each (38 tons) were hauled from the railroad tracks to the docks, where they were loaded on barges for shipment to the Proving Ground. One truck had sufficient power to drag the gun on level ground, but to negotiate an 8 per cent grade a second truck was necessary.

The marines were ready for the mounts when they arrived at Indian Head. The Bureau of Ordnance had provided, as part of the battery equipment, 120 h. p. gasoline tractors for hauling the guns. With the tractors hitched to the mounts, the guns were pulled up and down hill, over rough ground, and along hillsides. They proved themselves able to negotiate any ground over which the tractor itself was able to operate. Obstructions were mowed down, and yet the entire weight of the gun was so evenly and well distributed that no damage was done to roads when it was necessary to traverse them.

The guns were proof fired—and every expectation of the designers was fulfilled. The range of the gun, when firing at its maximum elevation of 40°, was 24,000 yards as predicted. The gun functioned perfectly, remaining steady on the point of aim even during continued firing. The caterpillar tread, locked in position by the brake, was as steady as a concrete foundation. The counter-recoil mechanism functioned perfectly.

Dispatch of men and material for France could have begun as early as October 15, and would then have been well toward completion on November 11. Due to a delay in fixing the port of debarkation, however, shipment was held up, and the armistice, of course, cut short the necessity for shipment. Had these seven-inch tractor mounts been placed in service, they would no doubt have given service equal to that given by the navy's 14-inch railway batteries.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A FEW NOTES ON ALTERNATING CURRENTS
INCLUDING REMARKS ON INDUCTION MOTORS AND RADIO TELEGRAPHY

By LIEUT. COMMANDER LESLEY B. ANDERSON, U. S. Navy

There is no doubt that alternating currents have come in the navy to stay. At present they are applied to ship propulsion, radio, gyro-compasses, submarine signalling, navy yard light and power; and, on a smaller scale, to gun firing, three-wire generators, testing sets, magnetos, engine speed indicators, and electric welding. There is such a large field for development that the use of alternating currents will probably be greatly extended within the next few years.

The theory and application of alternating currents is a subject that is highly technical and most difficult. To master it requires several years of handling apparatus as well as book study. The

NOTE.—1. This paper is submitted for the use of the Institute if so desired.

2. The matter covered is elementary in character. It deals with alternating currents, their generation and application to induction motors and to radio.

3. There are a great many officers in the service who never had the benefit of any instruction in alternating currents while at the Naval Academy. For them there is a great deal of time and energy to be expended if they would understand anything about the subject. They are required to know something if they are to pass examinations, for alternating currents are becoming more and more important each day.

4. These notes fill in the space between the starting of the subject and the place where most papers, lectures and pamphlets on the various applications of alternating currents begin. In order to understand even a simple description of electric drive, an elementary knowledge of the subject is necessary.

5. There are no books that I know of that give the elementary conception of the subject in concrete form. They all seem to go into such detail that it is almost impossible for the beginner to get a general idea from them.

6. I believe that these notes give the general idea in a simple manner. They are mostly explanations that were given to midshipmen and reserve officers in conjunction with the study of the text. They were used in lectures and talks in the recitation room.

average naval officer is not interested to that extent. He is interested from a professional point of view more in what can be done, than in how it is done; and yet at the same time he is required to know something about how it is done.

The information regarding how it is done is not readily available. It is generally camouflaged in a mass of integral signs. But there are certain peculiarities of alternating currents that can be understood without introducing higher mathematics, and I believe that a general idea of the subject can be obtained without taking up a very great amount of time.

Alternating currents can be used for most of the things that direct currents can, and they are cheaper. They also can be used for some things that direct currents cannot. On the other hand, there are some things that alternating currents cannot do; for instance, only direct current can be used for charging storage batteries and, as will be shown later, for exciting the field of an alternator; so although A. C. is coming into greater use every day, it can never entirely replace direct current.

To start with, every one knows that an alternating current flows half the time in one direction and half the time in the opposite direction; and that reversals of direction are frequent. The question is, How can it be made to do work in one direction, so to speak, such as making a lamp burn steadily or turning over the *New Mexico's* propellers?

In the case of the lamp the explanation is easy. Electric current flowing in a wire will heat the wire. If the wire can be made hot enough it will give out light. Suppose the wire in question is the filament of a lamp. It does not make any difference to the filament whether the current is passed through it from starboard to port or from port to starboard. It is heated if current is passed through it. We can change the direction of the current as often as we please. It is the current that does the heating, and not the direction. It follows that alternating current can be used for the purpose of heating the filament just as well as direct current. Of course, the current must be supplied at proper voltage, and the frequency must be above 60 in order to prevent flickering. If these precautions are observed, the light is just as steady and effective as any that a direct current could produce.

Alternating currents require a circuit to run around on just as direct currents do. Voltage is necessary to produce any kind of current, but it must be an alternating voltage to produce an alternating current. This brings us to the first peculiarity of alternating currents, which is, that alternating voltages and currents do not of necessity act together; that is, they are not necessarily in phase. In some circuits the current is ahead of the voltage, while in others the voltage is ahead of the current. Alternating currents may "lead," "lag," or be "in phase," depending on the characteristics of the circuit. There are three factors which taken together impede the flow of alternating current: resistance, inductive reactance, and condensive reactance. While resistance tends to keep the current in phase with the voltage, both inductive and condensive reactance tend to throw it out of phase; their action is at right angles to the action of resistance. At the same time, they act opposite to each other. Inductive reactance tends to make the current lag; while condensive reactance tends to make it lead. There are several ways of proving these statements, but as the principal difficulty in studying alternating currents is the mastering of this and other proofs, let us for the present be satisfied with saying that it can be proved. It is the very foundation of the subject, consequently of the utmost importance. The amount that the current lags or leads is really a time interval, but it is not measured as such. For the purpose of measurement we consider that a cycle is made up of 360 electrical degrees, then we state the amount of phase difference as an angle, called the phase angle, and measured in degrees.

At this point it is necessary to introduce a few definitions. As an alternating current is continuously reversing its direction, it is convenient to consider one direction as positive, and the opposite as negative.

Cycle—One complete set of positive and negative values of an alternating current—360 electrical degrees.

Alternation—Half a cycle.

Period—The time required for the current to pass through one cycle.

Frequency—The number of cycles or periods per second.

High Frequency—Above 100,000 cycles per second.

Radio Frequency—From 20,000 to 1,000,000 or 2,000,000 cycles per second.

Audio Frequency—Below 20,000 cycles per second.

NOTE.—The frequency used for power transmission is about 25 cycles, for lighting about 60.

Inductance—Every conductor carrying current is surrounded by a magnetic field, which is brought into existence by the current. Any change in the magnitude of the current causes a corresponding change in the magnetic field. The field then, in changing, reacts on the conductor and induces in it an E. M. F. The induced E. M. F. opposes the change of current. When the current is increasing, the induced E. M. F. tends to keep it from doing so, therefore acts in a direction opposite to the current; when the current is decreasing in magnitude, the induced E. M. F. tends to keep it from doing so, therefore acts in the same direction as the current. Inductance, then, is the ability of a circuit to set up, of its own accord, a counter E. M. F. following changes in the circuit current.

Capacity—The charge of electricity that a conductor will hold. Capacity depends upon the shape and size and location with respect to other conductors. The most common form of capacity is the condenser, of which there are many types. The quantity of electricity that a condenser will hold depends upon the voltage, as well as the capacity. A tank of so many cubic feet capacity will hold that many cubic feet of air, but more air can be put into the tank by increasing the pressure; also, air can be taken out, thus reducing the pressure. It is the same thing with condensers; in that case voltage corresponds to pressure. There is thus a distinction between quantity and capacity.

In this paper certain symbols, which are generally accepted as standard, will be used:

A. C.—Alternating current.

D. C.—Direct current.

E. M. F. or simply E.—Voltage, or electromotive force.

I—Current.

R—Resistance.

L—Inductance.

C—Capacity.

X_L—Inductance reactance, which is equal numerically to $2\pi fL$.

X_c—Condensive reactance, which is equal numerically to $\frac{1}{2\pi fc}$.

X—Reactance, the algebraic sum of the condensive and inductive reactances.

Z—Impedance.

Θ—Phase angle, angle between the current and the voltage.

f—Frequency.

This is enough of the currents for the present. How they are generated is of more interest. After a short investigation of alternators we will be better prepared to understand the action of the currents a little better.

There are two conceptions of the generation of E. M. F., either of which can be used when it is the one best suited to the conditions. The first is, that an E. M. F. is generated in a conductor when it cuts lines of magnetic force; the second is, that an E. M. F. is generated in a coil or loop when there is a change in the number of lines of magnetic force threading through it. The first is the conception that is easiest to apply to generators, the second to transformers.

A generator consists essentially of an armature and a magnetic field. The field consists of magnetic lines of force. It is created by electromagnets called poles, which are designated North and South. The armature consists of the cutting conductors. The armature bars cut the lines of force and E. M. F.'s are induced in the bars. If the circuit is completed a current will flow. In connection with this conception relative motion of the cutting conductors and the lines of force is all that is required to generate an E. M. F., so it is immaterial whether the lines move or whether the conductors move.

Generator armatures generate alternating E. M. F.'s, which can be rectified by means of a commutator if direct current is required. If alternating current is required, the commutator is left off and collector rings used instead. The leads from the armature are then connected to the rings, and brushes take off the current as with direct current machines.

If rings are installed in addition to the commutator, and proper connections made, both alternating and direct current can be taken from the same armature at the same time. The direct current is taken off the commutator and the alternating current off the rings. Such machines are actually made and are called

double current generators. Three-wire generators have an alternating current end as well as a direct current end, both connected to the same armature.

There are three general types of alternating current generators or alternators: First, the revolving armature type; second, the revolving field type; third, the inductor type in which both the armature and field are stationary.

The revolving armature type does not differ greatly from a direct current machine. The field is excited by direct current taken from an independent source. This source is sometimes a D. C. generator on the main shaft or belt driven from the main shaft. It may be an entirely independent D. C. generator. It is usually called an " exciter." In place of the cummutator collector rings are placed on the shaft. From the collector rings brushes take off the alternating current. Only small machines are of this type.

The revolving field type is the most common type of alternator. The armature is wound on the stator, while the field windings or poles are secured to the shaft. The high voltage generated cannot be handled by brushes, so it is necessary to use the stationary armature. The armature windings and leads can be made as heavy and rugged as desired. As stated before, relative motion of conductors and magnetic lines of force is all that is required to generate E. M. F., so it is immaterial whether the lines move or the cutting conductors themselves. The field windings are excited by D. C. supplied by brush contact on slip rings. The D. C. voltage is low enough to be handled in this way.

The inductor type has both the armature and the field windings on the stator. The rotor is an iron drum which has projections equally spaced around it. There are as many projections as there are poles. When a projection is under a pole the reluctance of the magnetic circuit is not very great, but when it is midway between poles there is considerable reluctance. The result is a varying flux which induces an alternating current in the armature.

All the above types may be made single phase or polyphase.

Let us first consider the revolving field type. Fig. 1 gives an elementary conception of such a machine.

The moving part, or rotor, has counter-clockwise direction of rotation. Lines of force projecting radially from the poles sweep by the bars of the armature winding and are cut. As alternate

North and South poles follow each other by the armature bars, alternating voltages are generated in the armature. It must be remembered that alternators are not self-exciting like D. C. machines. The exciting current is direct current and comes from an outside source. The polarity of the field does not change, for

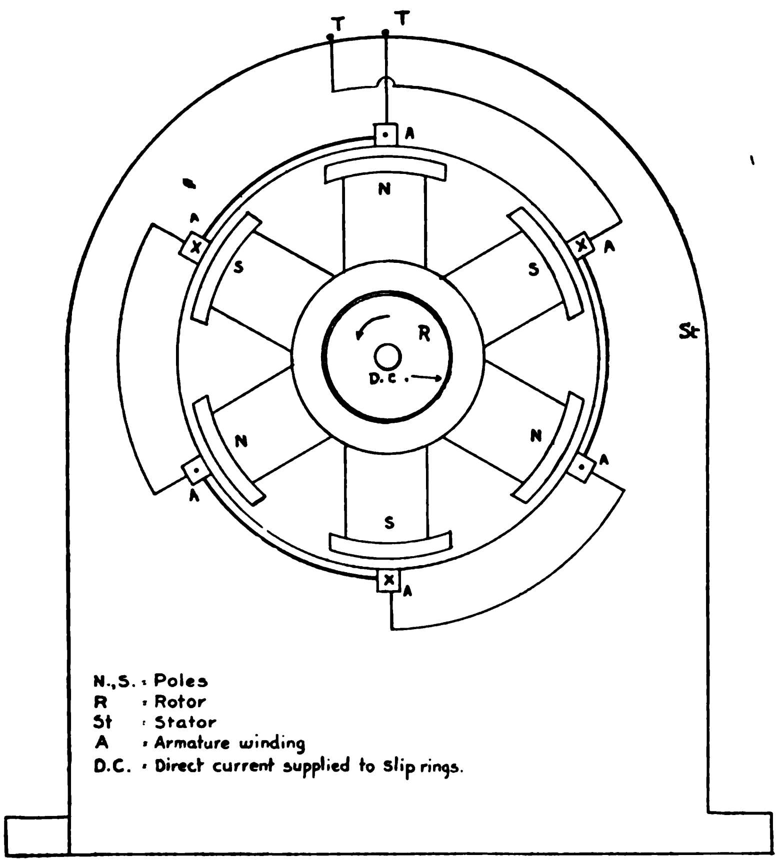


FIG. 1.

by using D. C. a North pole is always a North pole. It is only in the armature that the current is alternating.

The current generated is a periodic current. It may be represented graphically by the sine curve, which is also periodic. The different values of the current during the cycle are plotted as ordinates, while the horizontal axis is graduated in electrical de-

grees. One direction of the current is assumed as positive and plotted above the line. The other direction is then negative and plotted below the line, Fig. 2.

A conventional way of representing the direction in which a current is flowing is by using an arrow. When the wire is drawn lengthwise the head of the arrow points with the current. When the wire is end-on, the same idea is used; it is merely carried a little further and a cross representing the tail of the arrow shows the current flowing into the paper; a dot signifies the point of the

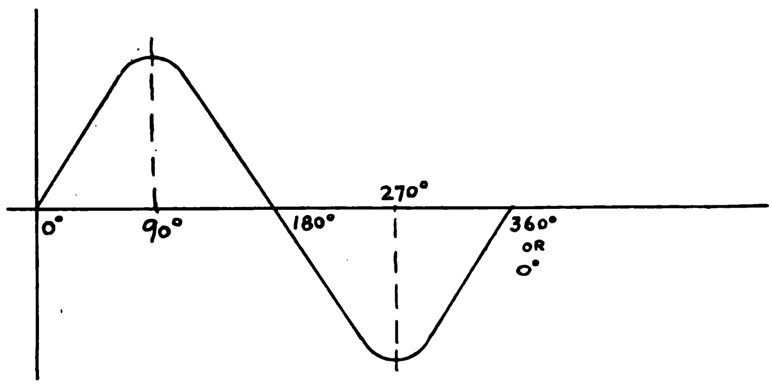


FIG. 2.

arrow and shows current flowing out from the paper towards the reader. Thus, current flowing into the paper:

$$\otimes$$

Current flowing out of the paper:

$$\odot$$

The action of the alternator may be made a little plainer by the accompanying plan, Fig. 3.

Fig. 3 shows an armature coil under which the poles are passing. The North pole is shown under one side of the coil, while the South pole is under the other side. That armatures are actually wound with fractional pitch is not here considered. The two poles thus act together. The current generated flows in one direction around the coil. When the poles have moved 180 electrical degrees, the current in the coil is reversed, so an alternating current is generated in the coil. These conditions are

shown in the figure. This conception is that of a single phase or simple alternator.

It can be seen that a whole new armature winding can be added to the stator, independent of the first, with its cutting conductors placed half-way between the bars of the original winding. If so, we have the elementary conception of the two-phase alternator. The current from the first winding is taken to two

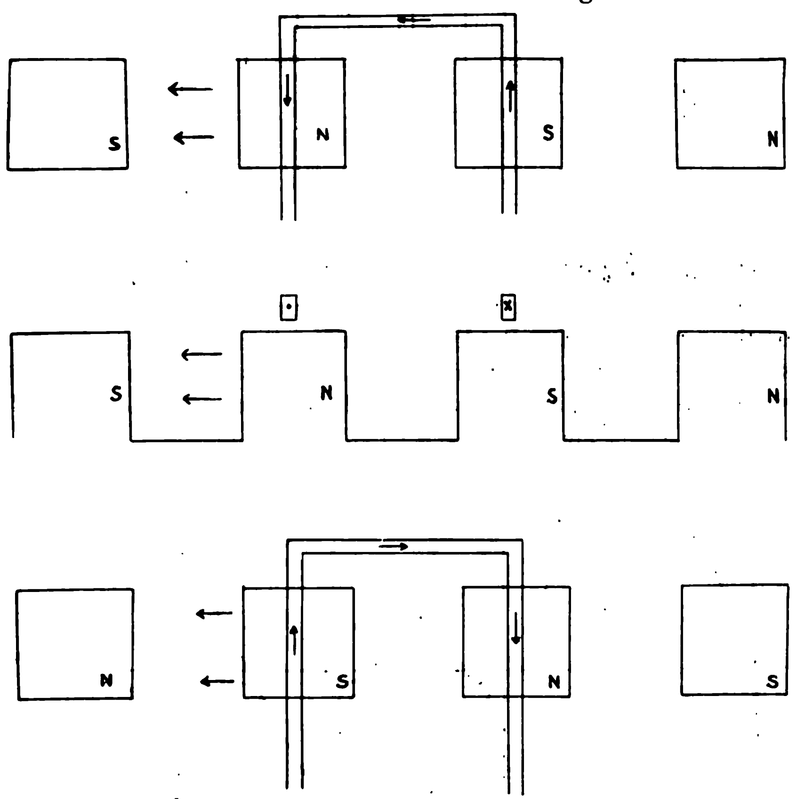


FIG. 3.

terminals, likewise the current from the second winding is taken to two terminals, making four terminals in all. Two distinct and separate currents are generated, which are similar in all respects, except that one is 90 electrical degrees behind the other in phase. The second winding, as stated, is 90 degrees from the first. Similar bars were placed half-way between the bars of the first winding. As one bar of the first winding is under a North pole

and the other under a South pole, the windings must be 180 degrees apart; half-way between them, then, is 90 degrees. See Fig. 4.

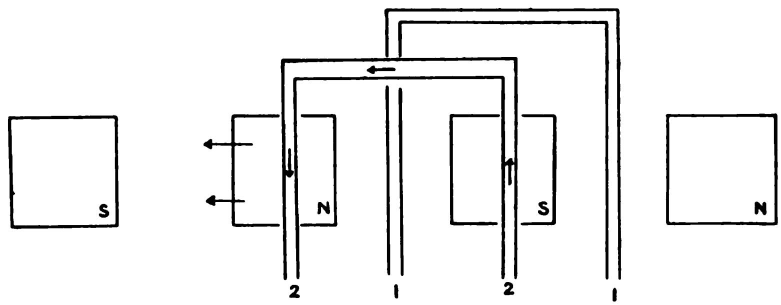


FIG. 4.

The curve for this current could be plotted in the same manner as the first was plotted; in fact, both curves could be plotted on the same diagram. By doing so we can get an accurate representation of what the currents are doing at each instant; or, to state it differently, an idea of their phase relations. See Fig. 5.

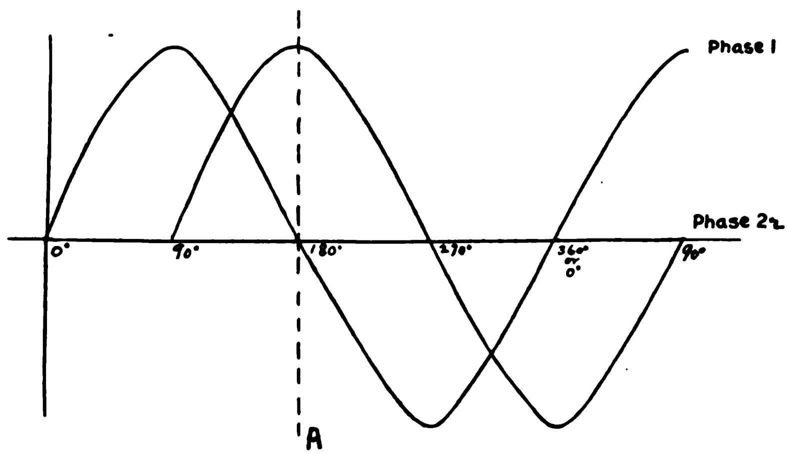


FIG. 5.

The winding of Fig. 4 is at the point *A* of Fig. 5; that is, the current in phase 1 is zero, while phase 2 is positive and maximum.

This same principle can be further extended to the elementary conception of the three-phase alternator. Instead of bisecting the

distance between the cutting bars of the first winding, suppose we trisect it. Also, instead of adding one new winding, suppose we add two windings. The leading edges of the coils are placed 120 electrical degrees apart in this case. The resulting

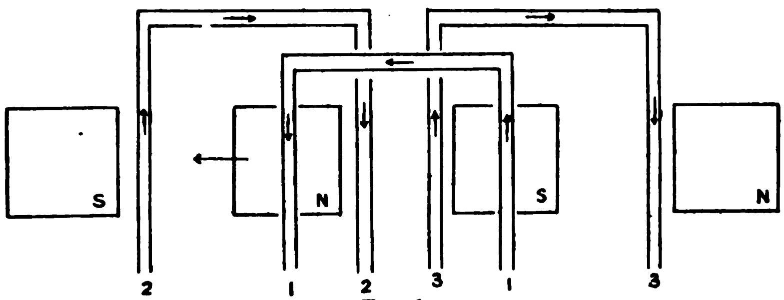


FIG. 6.

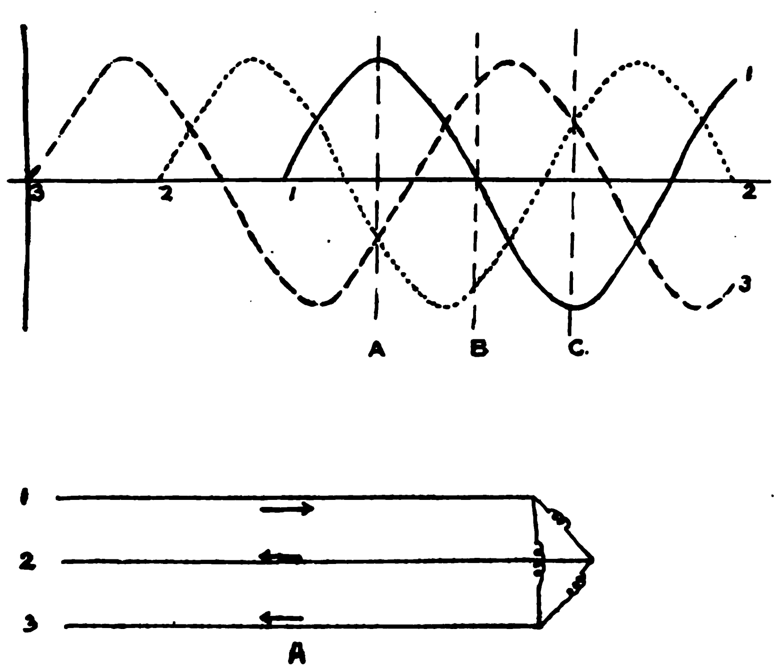


FIG. 7.—Line Wires Carrying the Currents Shown Above.

currents can then be plotted as three sine curves 120 degrees apart. See Figs. 6 and 7.

At the instant shown in Fig. 6, which is the point *A* of Fig. 7, current in phase 1 is positive and maximum; current in phase 2

is negative and increasing; current in phase 3 is negative and decreasing. At this point, as all others, the sum of the positive currents is equal to the sum of the negative.

Direct currents are ordinarily handled on two wires, one positive and the other negative; sometimes there is a ground return, but the effect is that of two wires. The three-wire system, so called, does not extend beyond the switchboard. The object of the three-wire generator is to provide two different voltages. There is a greater efficiency in running motors at higher voltages than lamps will stand, so the motors are connected between outside wires and take about 240 volts; while the lamps are connected outside to middle and take 120 volts.

Alternating currents can use two wires for each phase, but it is also possible to effect a saving of wiring when using polyphase current. Two-phase current can be handled on three wires, if the load is balanced. The fact that the resultant of three alternating currents 120 electrical degrees apart is zero, makes it possible to use three wires for three-phase current.

Suppose that the three wires are connected together at the far end. The current in each wire will be alternating just as in a simple alternator. But an alternating current requires a complete circuit, so that while current is going out on one wire it is returning over one or both of the others. This can be easily understood by referring to Fig. 7, and considering different points along the axis.

At *A*, current is flowing out over phase 1 and returning over 2 and 3.

At *B*, current is zero in phase 1. It is flowing out over phase 3 and returning over phase 2.

At *C*, current is flowing out over both phases 2 and 3, and returning over phase 1.

Any other points can be taken if the action is not made clear by considering the three already taken.

In connection with alternating currents a term which is frequently used is "power factor." A machine may be spoken of as having a high-power factor or low-power factor. High-power factor, of course, is the more desirable; and engineers, when designing, devote considerable time to methods of obtaining it. It has been shown that an alternating current is not always in phase with the voltage. The amount that the current lags or

leads is expressed as an angle. The natural cosine of this angle, which is called the phase angle, is the power factor. The more nearly the current is in phase with the voltage, the higher is the power factor; the cosine of zero degrees being one, while that of 90 degrees is zero.

We can represent current and voltage vectorially; for example, a lagging current, thus:

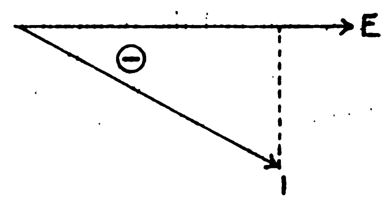


FIG. 8.

and from the figure we can see that $I \cos \theta$ is that component of the current which is in phase with the voltage. The total power delivered to a circuit is the product of the voltage and the component of the current which is in phase with the voltage. Or the total power is the product of three quantities, namely, voltage, current and power factor, for which an equation may be written:

$$P = EI \cos \theta.$$

$$\text{Watts} = \text{volts} \times \text{amperes} \times \text{power factor}.$$

In electrical work power is usually expressed in watts or kilowatts. If for any reason we want to change this unit to horsepower we can do so by observing the relation that one horsepower is equal to 746 watts. A kilowatt is 1000 watts.

When a machine is in operation the power factor can be determined from readings of an ammeter, voltmeter, and wattmeter. For the wattmeter reading is $EI \cos \theta$, which divided by EI, the product of the other two readings, gives $\cos \theta$, the power factor.

While an alternator may be delivering current at a certain voltage, the power delivered depends upon the power factor of the load, which is a variable and depends entirely on the load and not upon any characteristics of the alternator. Therefore, alternators are rated in volt amperes, or kilovolt amperes and not in watts or kilowatts.

The constants which impede the flow of alternating currents are three in number. They are all in the nature of a resistance and all are expressed in ohms. They consist of resistance, inductive reactance, and condensive reactance. As stated earlier, resistance tends to keep the current in phase with the voltage; inductive reactance to make it lag; and condensive reactance to make it lead. To find the impedance, which is the resultant of the three, we first take the difference between the inductive and condensive reactances, then find the resultant of the resistance and the remaining reactance. We may do this graphically, as in Fig. 8; or, as it is evident that we are merely finding the hypotenuse of a right triangle, we can do it just as well by the old familiar sum of the squares methods: $Z^2=R^2+X^2$, where $X^2=(X_L-X_C)^2$.

The last quantity of this equation is always positive, for the difference between the two numbers is squared, and the square is positive where the difference is positive or negative.

Ohm's law, which applies to direct currents, may be expressed as an equation: $I=\frac{E}{R}$, where I is the current in amperes, E the voltage in volts, and R the resistance in ohms. With alternating currents this equation takes the form: $I=\frac{E}{Z}$, where I is the current in amperes, E the voltage in volts, and Z the impedance in ohms. Knowing any two we can find the other one. This equation is the foundation of all A. C. calculations.

We can now turn our attention to the induction motor. It seems weird at first that a propeller shaft can be made to turn over at any desired speed when nothing is touching it, but anything that is weird is interesting.

We are familiar with generator action which is that relative motion of a conductor, and a magnetic field induces current in the conductor. Here we have mechanical power being supplied and producing electrical power. The motor is just the opposite, for electrical power is supplied and is converted by the motor into mechanical.

The action of a motor depends upon the fact that a conductor carrying current and in a magnetic field will tend to move. If the stator sets up the magnetic field, and the conductors carrying current are secured to the shaft, the shaft will revolve. The rotor

windings of most motors are supplied current by means of brush contact on a commutator or slip rings; but the rotor windings of an induction motor are not supplied current. The rotor currents are all induced currents. The stator is supplied current. It sets up a magnetic field. This field revolves, the conductors of the rotor cut the magnetic lines of force of the revolving field, inducing currents in the rotor windings. Then we have the conditions which must be fulfilled in a motor; namely, a conductor carrying current in a magnetic field, so the rotor revolves.

This requires explanation. It is best to take one thing at a time, so the first step will be the consideration of the revolving magnetic field. The stator does not revolve, merely the magnetic field set up by the stator. In order to understand it we must get back to first principles.

A conductor carrying current has surrounding it magnetic lines of force, or a magnetic flux. If the conductor is bent around in a circle or loop all the lines that were on one side of the wire will be sent through the loop. By increasing the number of turns of the loop, we increase the number of magnetic lines threading through it. Solenoids, or electromagnets, are made this way. The lines threading through the coil are the same as those of any magnet, so that one end of the coil is a North pole and the other end a South pole. If we reverse the current through the coil, we reverse the polarity of the magnet; what was North now becomes South, for the flux is now in the opposite direction.

The winding on the stator of an induction motor has the same effect as the coil, lines of force thread through it, so a magnetic field is set up. Consider the two-phase stator shown in Fig. 9 A. Phase 1 sets up a field with the North pole at one side when the current is flowing in one direction. When the current is reversed the side that was North becomes South. So phase 1 sets up an alternating magnetic field. The frequency of the field is the same as the frequency of the stator current, for every time the current is reversed the field is also reversed.

Phase 2 does the same as phase 1. Its windings are placed 90 degrees from phase 1, so its field is at right angles to the field of phase 1. The current in phase 2 is 90 degrees later than the current of phase 1.

That the result is a revolving magnetic field can be seen if we consider the action of the two-phase current in Fig. 9.

At the instant *A*, current in phase 1 is maximum and positive, while phase 2 has zero current. The direction of the resulting magnetic field is as shown at *A* in Fig. 9.

At the instant *C*, current in phase 2 is maximum and positive, while phase 1 has zero current. The resulting direction of the magnetic field is as shown at *C* in Fig. 9.

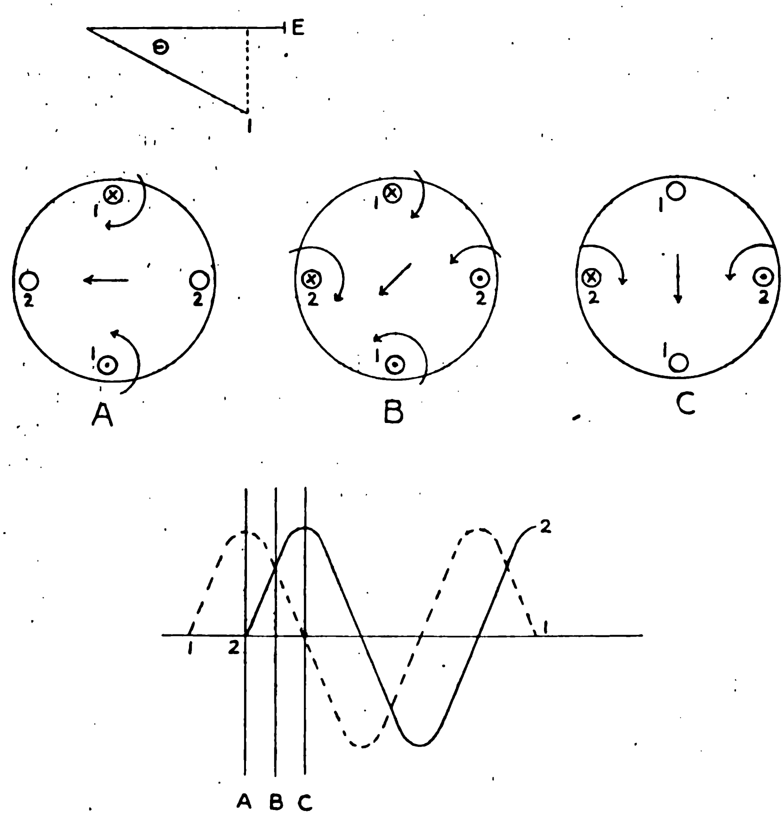


FIG. 9.

This shows that the field has changed direction 90 degrees, but to prove that it has actually revolved it is necessary to consider one or more intermediate points, such as *B*. At the instant *B*, current is flowing in both phase 1 and phase 2. The field set up will be the resultant of the fields of each phase, the direction of which is shown at *B* in Fig. 9.

We can follow the current through a complete cycle and will find that the magnetic field has actually made one complete revolution. The field revolves in synchronism with the current; that is, it goes through just as many electrical degrees as the current does.

Three-phase current has the same effect as two-phase. It sets up a revolving magnetic field which revolves at synchronous speed. Fig. 10 can be followed through in the same manner as was Fig. 9.

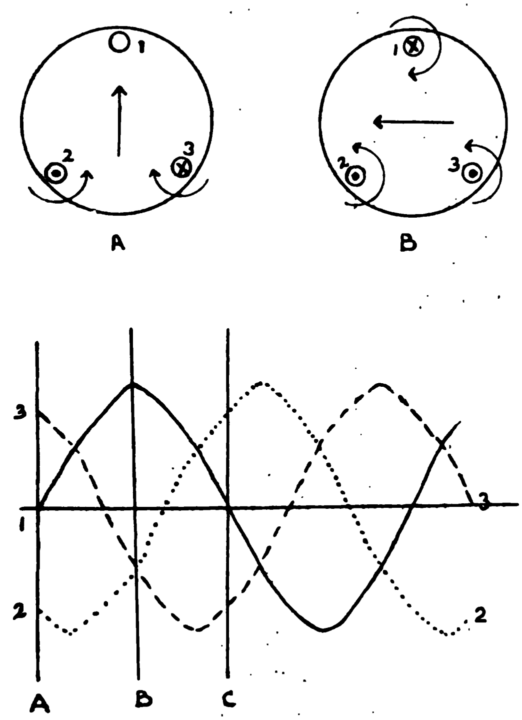


FIG. 10.

At point A, phase 1 is zero, phase 2 is negative, phase 3 is positive. The resulting direction of the field is shown at A.

At point B, phase 1 is positive, phases 2 and 3 are negative. The resulting field is shown at B.

At point C, phase 1 is zero, phase 2 is positive and phase 3 is negative. The resulting direction of the field is shown at C.

These three points have followed the current through 180 electrical degrees, and the field has revolved 180 electrical degrees.

At the instant of starting, the rotor, of course, is stationary. The bars of the rotor winding cut the lines of the revolving magnetic field, inducing current in the rotor windings. This is simply generator action. In addition we get motor action, for we have the condition of a conductor carrying current in a magnetic field. This is the principle of the induction motor.

The rotor cannot travel faster than the field, for if it did it would cut the lines in the opposite direction and would be acted on in the opposite direction and the tendency would be to turn the rotor in the opposite direction. This quality keeps the propellers from racing. If the tendency of the rotor is to turn in the opposite direction it would of course be slowed down.

The rotor cannot turn at synchronous speed, that is, at the same speed as the magnetic field, for then there would be no lines cut, and consequently no current induced in the rotor windings. Therefore the rotor actually turns at a speed less than synchronous speed. The rotor is said to slip. Slip is expressed in per cent, and is equal to

$$\frac{\text{Synchronous speed} - \text{actual speed}}{\text{Synchronous speed}}.$$

The slip of the *Jupiter* at full speed is about 1.5 per cent.

The general idea of induction motor is really quite simple. Now we can see how it is possible for current that is rapidly changing its direction to do work in one direction.

The induction motor has made the gyro-compass and electric ship propulsion practical.

Electric drive or electric ship propulsion is one form of speed reduction. If an alternator and the motor it is running have the same number of poles they will turn at the same speed (neglecting slip). If the motor has twice as many poles as the alternator it will revolve at half the alternator's speed.

In the case of the *Jupiter* the alternator is wound for two poles, the motors for 36, so that the speed reduction is about 18 to 1. The revolving field and the current go through the same number of electrical degrees; but while the alternator is so wound that it has 360 electrical degrees for 360 degrees of arc, the motor has 18×360, or 6480 electrical degrees for 360 degrees of arc.

A single phase induction motor is possible, although single phase current does not set up a revolving field. Once the rotor is up to speed the alternating field of single phase current will keep it going. The problem is how to start the motor. One method is to wind the stator as though two-phase current were to be used. In the leads to one phase put a condenser making the current lead the current in the other winding. Or in one lead put a large resistance making the current more nearly in phase with the voltage in that branch, and consequently ahead of the current in the other. Either makes a difference in the phase between the currents in the two windings, so the effect is the same as two-phase current. After the motor gets up to speed, one phase can be cut out. This is called the split phase method of starting.

The *New Mexico* has two separate stator windings, one for 24 poles and one for 36 poles, so that a large change of speed can be made by changing from one winding to the other. As with all electrically driven ships small changes of speed are made by changing the speed of the alternator.

There are three general types of rotor windings: The phase wound, the squirrel cage and the double squirrel cage. The *Jupiter* is typical of the first, gyro-compasses of the second, and the *New Mexico* of the third.

The phase wound rotor is merely a counterpart of the stator, being wound for the same number of phases. Instead of being connected to a source of current, the terminals of each phase are led to slip-rings on the shaft; here brushes take off the current which is led to some sort of resistance unit. At starting, the revolving field is turning at synchronous speed, therefore the magnetic lines are cut at maximum rate as they pass the stationary rotor bars. In order to keep the induced currents from being abnormally large it is necessary to introduce resistance into the circuit. When the rotor gets up to speed the rate at which the magnetic lines are cut is much smaller, therefore the induced current is much less. The resistance can then be cut out, or, as is usually done, short circuited.

The squirrel cage is much simpler. The winding consists of bars parallel to the shaft, around the rotor. A ring at each end touches all the conductors. Everything is thus short circuited, so the induced currents choose their own paths.

The double squirrel cage has two windings that parallel each other but are not connected. One is high resistance, the other is high reactance. Reactance depends upon the frequency of the current, for it increases with the rate of change of current. Therefore at starting the frequency being the greatest most of the current will be sent through the high resistance winding. As the rotor gets up to speed and the frequency becomes less, more current is sent through the low resistance winding. In this type of rotor, then, the insertion of starting resistance is automatic.

There is no provision for inserting starting resistance in the squirrel cage rotor.

In large motors there is considerable heat developed in the resistance which is used at starting. The heat thus developed is dissipated by using water cooled resistance units, or water rheostats, and by circulating air through the machine. The designer in addition to providing means of carrying off the heat developed has a big insulation problem to contend with. The winding in all rotors is of course insulated from the rotor body or frame.

There is one other feature of induction motors that should be mentioned before leaving the subject, that is the matter of reversal of direction of rotation. The two-phase rotor is reversed by reversing one phase, the three-phase by interchanging two of the phases. That this is so can be seen in Figs. 9 and 10 which show elementary stator windings. If the direction of rotation of the revolving magnetic field is accomplished the reversal of the rotor follows.

Radio depends upon the fact that electromagnetic waves can be sent through space. Having established that fact various methods of signaling by means of these waves were developed. Signals can be made by interrupting the waves or by varying them in some way.

The velocity of the waves is 300,000,000 meters per second. It cannot be changed, but the length of the waves can be changed by varying the frequency. The frequency, in turn, depends upon the capacity and inductance of the radiating circuit. So it is only necessary to vary one or the other of these constants, L or C, in order to vary the wave length.

The mathematics involved is very easy to follow and shows the relations so well that it will be introduced here.

Let V stand for velocity, λ for wave length, f for frequency, and, as previously given, R resistance, L inductance, C capacity, X reactance, X_L inductive reactance, X_C condensive reactance. Then:

$$(1)\quad \lambda=\frac{V}{f}.$$

$$I=\frac{E}{Z}.$$

$$Z=\sqrt{R^2+X^2}.$$

$$X^2=(X_L-X_C)^2.$$

$$X_L=2\pi fL.$$

$$X_C=\frac{1}{2\pi fC}.$$

$$\therefore I=\frac{E}{\sqrt{R^2+\left(2\pi fL-\frac{1}{2\pi fC}\right)^2}}.$$

which of course is maximum when the second expression under the radical is equal to zero, or when $2\pi fL=\frac{1}{2\pi fC}$. This condition of the circuit is called resonance. Two circuits are said to be in resonance when they have the same wave length.

The frequency at which this maximum current occurs is called the critical frequency; it can be found from the last expression to be

$$f=\frac{1}{2\pi\sqrt{LC}}.$$

Substitute in equation (1)

$$\lambda=\frac{V}{f}=V2\pi\sqrt{LC},$$

which can be further simplified to $\lambda=1884\sqrt{LC}$, where L is microhenries and C is microfarads. This is important because "tuning" is merely changing the wave length, and this shows that it is accomplished by varying either capacity or inductance, or both.

Varying the wave length by changing the inductance is one of the methods that is used in sending signals. A continuous wave is sent out. When the key is pressed it changes the inductance of the circuit, therefore the wave length. The receiving station

is tuned to receive only that wave length which is radiated when the key is pressed.

With this in mind the elementary idea of the "arc sets," such as are used at high-power stations can be easily understood. Fig. 11 gives the elementary layout.

Even before radio existed it was known that an arc produced by D. C. would set up electric oscillations, if in circuit with an inductance and a condenser; and that these oscillations were

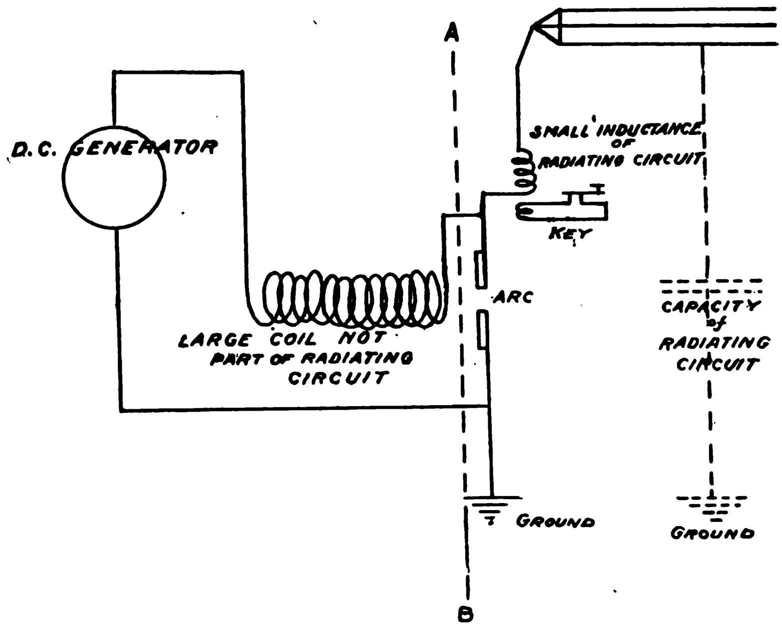


FIG. 11.

produced continuously if the circuit was properly adjusted. It can be seen from the figure that the arc has an inductance in circuit with it. The aerial and the ground or ballast with air between form the condenser, which is shown dotted in the figure. The circuit is completed through the two grounds.

The large inductance serves two purposes. It prevents rush of current back over the line, and it blows out the arc. It has nothing to do with the LC of the set. It is not a part of the radiating circuit. The current that passes through it is unidirectional. The radiating circuit is everything to the right of the dotted line AB. It is a complete circuit in itself, as stated above.

The key in small sets is so connected that when it is closed it short circuits part of the small inductance of the radiating circuit, thus changing the inductance. In large sets it is inductively coupled, as shown in Fig. 11. Due to transformer action current is set up in the key circuit when the key is closed. This current creates its own field, which in turn reacts on the already existing field of the coil in the radiating circuit, changing the inductance of this circuit, due to the change of magnetic flux. Consequently, the wave length is changed. This interaction of two coils on each other is called "mutual inductance" to distinguish from self-inductance already described.

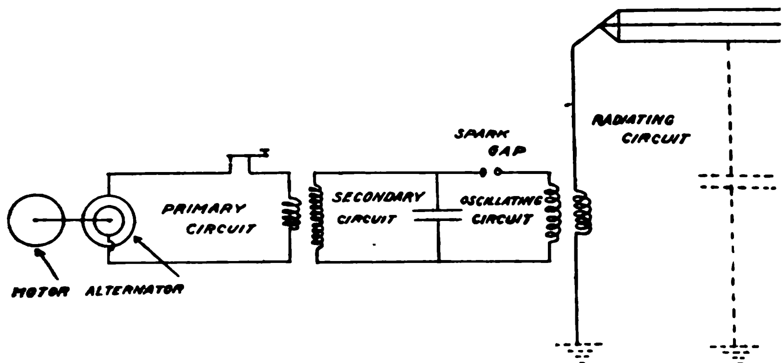


FIG. 12.

The key can be operated locally, or if connected through proper relay, messages can be sent from a distance. For instance, an operator in Washington can send signals out over the station at Annapolis.

A second method of making signals with these electromagnetic waves is to have a key which completes the circuit. Then waves are only sent out when the key is pressed. The system is used with spark sets.

"Spark sets" require A. C. in the primary circuit. The inductor type of alternator is used to supply the current. The frequency is 500 cycles per second. This frequency is only in the primary and secondary circuits. The radiating circuit depends on its own Lc for its frequency, just as in the previous set. Fig. 12 shows the elementary layout.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

GREAT CIRCLE SAILING—A FEW "WRINKLES" TO SAVE TIME

By COMMANDER H. G. S. WALLACE, U. S. Navy

Now that so many ships are making trips across the Atlantic, a few notes on great circle sailing may be of timely interest.

There are in common use two methods of getting the great circle distance between two points. These are: (1) By measurement from the great circle chart; (2) by computation from formulæ derived from Napier's rules.

The first of these methods, measurement from the great circle chart, requires (usually) a rather long preliminary study of the method (or methods, as two are given in the printed instructions on the chart) before one is sufficiently familiar to start on the case in hand. In addition to the inconvenience and delay, the result attained is only approximate, and has a probable error in the neighborhood of 10 to 20 miles.

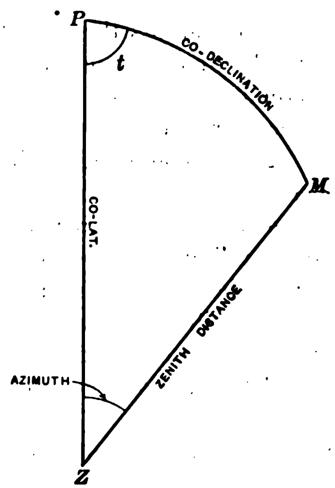
The second method, computation from Napier's rules, requires the navigator to burden his memory with a rarely used formula, or else to look it up in Bowditch or elsewhere before using; and after getting it, he must be familiar with the signs of the various functions in the various quadrants, and carefully observe them, or the result will be liable to error.

It requires no argument to prove that any method which involves little-used formulæ, or which requires a preliminary study, or which fails to give a reasonably correct answer, is faulty in actual service. The chances of mistakes are already too many, and anything which adds unnecessarily to these should be avoided.

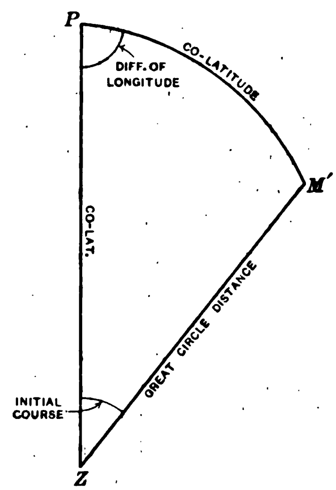
Happily there is an easier method, one which is available to the average navigator without any preliminary study, and which gives results that are not only accurate, but quickly attained. It is nothing else than our old friend, the Marcq Saint-Hilaire.

The analogy between the astronomical triangle and the terrestrial triangle is very close.

By comparing the two triangles in the figure, it appears at once how the Marcq Saint-Hilaire method is applicable, as it is simply necessary to substitute (1) the latitude of the destination in place of the declination of the heavenly body, and (2) the difference of longitude in place of the hour-angle. It is not even necessary to reduce the difference of longitude to time, as the haversine tables in Bowditch give the functions for one as readily as for the other. The zenith distance, reduced to minutes of arc, is the desired great circle distance between the two points.



ASTRONOMICAL TRIANGLE.
P = Pole.
Z = Zenith.
M = Heavenly body.



TERRESTRIAL TRIANGLE.
P = Pole.
Z = Zenith.
M' = Destination

Example.—Find the great circle distance between Lat. 45° 40′ N. Long. 2° 50′ W., and Lat. 41° 00′ N. Long. 50° 00′ W.

L_1	45° 40′ N.	λ_1	2° 50′ W.
L	41 00 N.	λ_2	50 00 W.
$L_1 \sim L_2$	4° 40′	$\Delta\lambda$	47 10

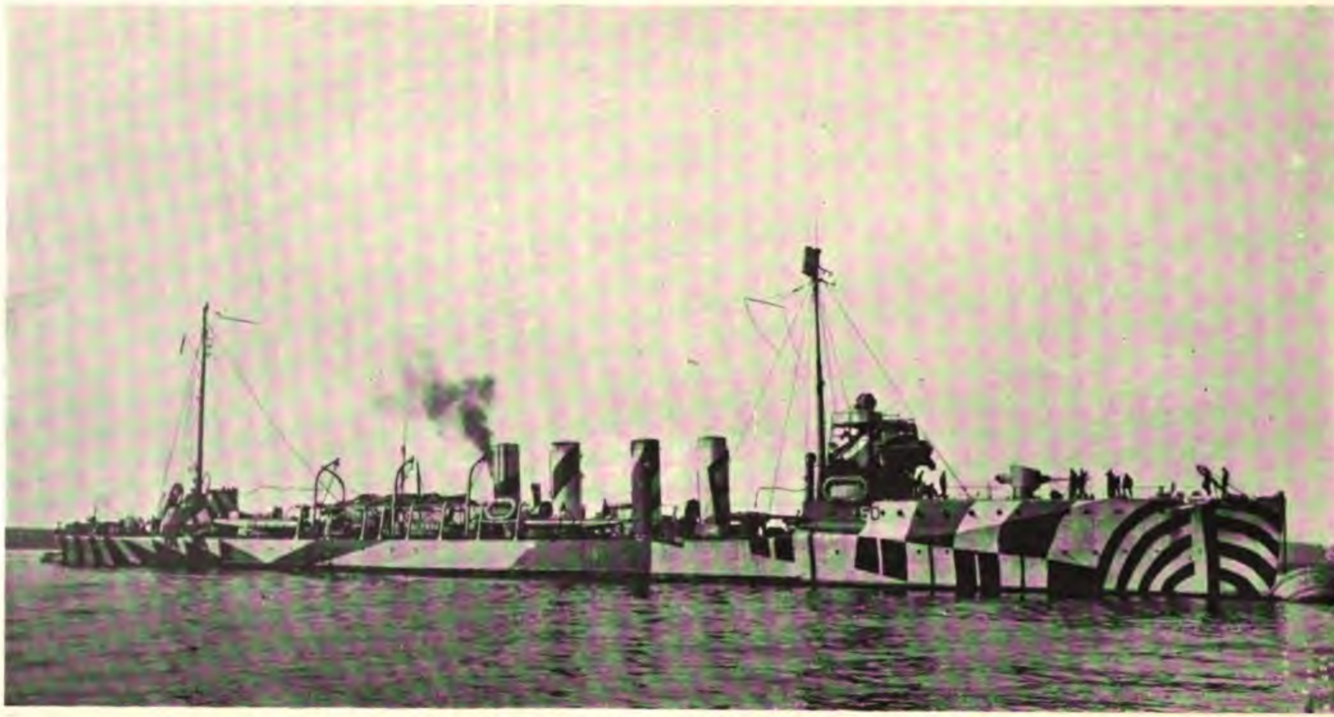
$\Delta\lambda$ 47° 10′ log hav 9.20430
L^1 45 40 log cos 9.84437
L_2 41 00 log cos 9.87778
log hav 8.92645.........N. hav .08443
$L_1 \sim L_2$ 4° 40′.......................N. hav .00166
Zenith distance 34° 07.5′..........N. hav .08609
Great circle distance 2047.5 miles.

The initial course is readily obtained by solving the same triangle to get the azimuth, using any of the well-known methods. In this case the difference of longitude must be reduced to time, as azimuth tables and diagrams do not have the hour-angle expressed in arc.

The easiest method of actually following a great circle is usually by drawing a straight line between the two points on a great circle chart, picking off points on the line every 5° or 10° apart, and plotting these points on a Mercator's chart, then connecting by a fair curve. If this method is followed, the course at any point may be taken directly from the chart by means of the parallel rulers. This is easier than computing the successive courses, and is equally satisfactory in practice.

The writer accidentally hit on the above method for computing the great circle distance, and wondered whether so easy and obvious a method could have escaped observation. It is not given in Bowditch, but it has since developed that the late edition of Muir (1918) contains the formula on p. 267, and an example is given on p. 270. It is, however, not pointed out that the formula is the same as that of the ordinary Marcq Saint-Hilaire sight, and the close analogy between the two might readily escape observation, even from a person making a fairly careful study of Muir.

It is believed that in any case the method will prove of interest to those who, not having a copy of Muir, have not seen it, or, having seen it, have not happened to notice the analogy.



U. S. S. "WADSWORTH."

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON HANDLING DESTROYERS

By Commander C. C. Slayton, U. S. Navy

Introduction

The writer has been hoping for a long time that some of the many really expert destroyer commanders would write about some of the results of their experiences and observations of handling destroyers.

Finally in sheer desperation, perhaps with the idea of "starting something," some observations of three rather busy years handling and watching others handle them under many and varied conditions have been jotted down. These notes are not intended as a treatise on "How to Handle Destroyers"; they are simply a few observations concerning some of the mistakes often made.

It must be remembered that no two vessels handle alike; also, that no two men will handle their ships exactly the same. No fixed rules can be laid down, and it is not the writer's desire to have these remarks considered as such. After all, experience is the best teacher, but it is hoped that these notes may be of value to the new men coming to command destroyers.

The handling of a destroyer alongside a dock or alongside other other vessels is to most destroyer men a never-failing source of fascination. A destroyer is a light vessel, very much affected by the wind, which has an effect on the high bow like that on the jib of a sailing vessel; a vessel of high power; swift; quick to answer the rudder; with fairly small turning circle; and withal so delicate that a little misjudgment may quite easily result in torn plates, a mowing down of your own or another's stanchions, bent gun training gears, damaged torpedo-tubes, damaged propeller guard, or propeller.

And never are the conditions exactly the same! How many times the young skipper, exasperated by what he thinks is a landing not 100 per cent seamanlike, exclaims, "Now why in the name of all that's holy didn't the darned stern swing in as it

usually does!" It is so easy to overlook one of the many little points, as wind, eddy currents, etc., a forgetfulness that may mean overtime work for the repair gang.

When many destroyers are based on a port, it becomes necessary for a great deal of this kind of ship handling, and experience has shown that under such conditions there will be a good many cases of minor damage. Our destroyer repair ships overseas will testify that the hull and upper deck fittings are frail structures, judging from the way they had to work to keep the destroyer on the job.

DIFFERENT DESTROYER TYPES

Before proceeding with an account of the mistakes commonly made, it would be well to examine some of the points wherein the several types of destroyers differ, in regard to maneuvering qualities.

The vessels before the 700-ton class are not considered in this article.

1. *Triple Screw 700- and 750-Ton.*—These have small fast moving screws, small turning leverage and small backing power.

In order to turn in a short space it is best to use the rudder and get way on, shifting rudder *when dead in the water.* The kick of the "inboard screw" backing as it churns when started is of great assistance.

The wind effect on the high bow of these destroyers is most marked, especially when backing.

The twin-screw boats have better turning leverage, but have the disadvantage of less backing power than later boats.

2. *Thousand-Ton Destroyers* with larger and slow moving screw, greater turning leverage and greater backing power, can ordinarily be turned in a very small circle, using one screw ahead and the other backing. They turn best with a little ahead motion of the ship. The wind has less "jib effect" on these on account of the high boat skids aft.

3. *Twelve-Hundred-Ton Destroyers* having more power are still easier to handle, but care must be taken to use this power judiciously, in order not to start ahead or astern with a rush. It has also been noted that one must anticipate a little, for a signal from the bridge does not result in a reversal or starting of the engine as quickly as in the smaller ones, and when they do start, as one captain said, "You know it." This slowness of starting may apply to only a few of the boats, for another captain says

that you get the effect of a reversal or change of engines very quickly.

The destroyers of the latest design should be particularly easy to handle, on account of their cut-away stern. This makes them very sensitive to rudder changes. Their deeper draft when loaded will make them less susceptible to the wind, which is a bugbear to most destroyer men, when it cannot be used to help. It may be remarked that the officer of the deck and steersman will have to be very much on the job when running before a quartering sea, due to excessive yawing, especially in shallow water.

REASONS FOR MISTAKES

1. Insufficient knowledge of the maneuvering qualities of the ship; how wind and tide effect its handling, and how to make allowances therefor.
2. Use of excessive speed.
3. Use of too little power.
4. Lack of confidence; indecision.
5. Insufficient or improper use of lines.

The remarks in this article are chiefly applicable to vessels of the " 1000-ton " type, except where a certain type is specifically mentioned.

INSUFFICIENT KNOWLEDGE

The knowledge of how ships will act under varying conditions is one which cannot altogether be learned from books, tactical data, or the thorough analysis of the effect of the rudder and screw in Knight; these should all be studied, but before one can become an expert at handling his ship a certain amount of experience must be had to round out his knowledge.

The quickest way to turn, in point of time, is at a fair speed, both engines ahead, and with full rudder. The slowest is with practically no way at all, one engine ahead, the other astern.

Therefore, desiring to get around in the shortest time, you should turn with as much headway as possible, consistent with safety. Ordinarily, to turn in a limited space with boats of the 1000-ton class, it will be found best to so regulate the speed that the effect of the engine going ahead is a little greater than that of the engine going astern. And, moreover, the more power (*not speed*) the quicker the turn.

But with the lighter 700- and 750-ton boats, especially those with the Parsons' installation, it will be found that it is almost

impossible to turn in a limited space without surging back and forth, and the continuous backing of one screw while the other is going ahead is hardly worth while, unless wind conditions are such as to help push the bow around. With these boats, the effect

WHAT THE "FISH BOAT" DID TO ME.

of the rudder is greater than screw current or sidewise pressure of the screw, as long as the ship has way; so that it is best not to shift the rudder, when the inboard screw is reversed, until the ship has lost all headway. An exception may be noted here that when the inboard screw first goes astern, an appreciable kick of the stern is felt which decreases as the headway is diminished. So it often may be found convenient to keep one engine going

ahead, and to start and to stop the inboard engine (going astern) from time to time. When the outboard engine starts ahead, the screw current acting on the rudder tends to diminish the turning effect of the rudder, due to ship moving ahead, and you must be prompt to shift the rudder.

A big factor with these boats is the lack of power. If you have only two boilers lighted, especially when you are just getting under way, any continued work with one engine backing and the other going ahead will soon kill your pressure, and you may find yourself adrift, not under control.

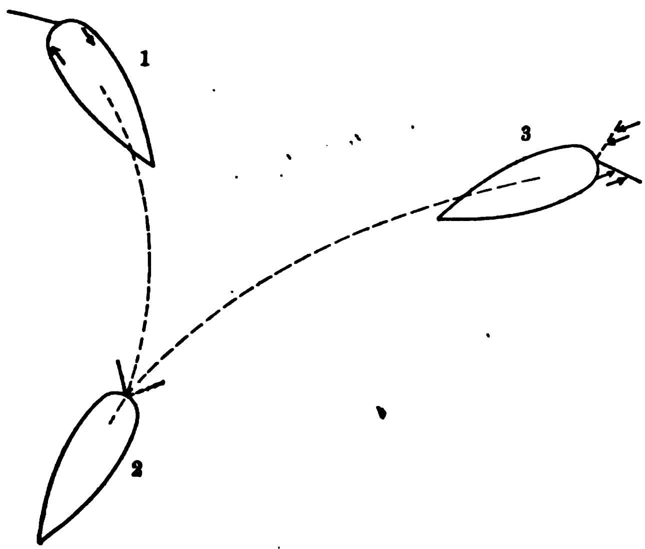


DIAGRAM A.—Turning a Destroyer.

Position 1: Port screw ahead; starboard backing; rudder full left.
Position 2: Starboard screw backing; port stopped. Shift rudder when dead in water.
Position 3: Screws as in Position 1. Arrows show forces acting against turning.

If it is necessary, due to vessels, buoys, etc., to gain distance astern while turning in a limited space (handling a "1000-tonner" or greater) the following point must be remembered: The rudder should be shifted *when headway is lost;* but, when going ahead after backing, the rudder should be shifted (or better yet brought amidships) *when the "outboard screw" is started ahead.*

In Diagram "A" a destroyer at (1), with right rudder, port screw ahead, starboard backing, turns quite well. Then port

engine is stopped, speed of starboard engine (backing) is increased. When dead in the water, rudder is shifted. Ship will turn, but not as much as when going ahead, because the effect of screw current is not so great. Now in position (3), if port engine is started ahead, it will be found that the screw current acting against the left rudder will tend to throw the stern to starboard, nullifying what you want to do. On the other hand, if the rudder is immediately *shifted,* the pressure of the water due to the ship's sternboard will also tend to throw the stern to starboard.

Therefore, in this case, it will probably be found best to put the rudder amidships until sternboard is checked, then give right rudder. Or, put rudder amidships, go ahead standard or full *both,* give right rudder immediately, and as soon as sternboard is checked, slow down to safe working conditions. This is a good example of the use of *power,* as differentiated from *speed,* a subject that will be touched later.

Be sure and know the right time to back in making a landing. A landing made when headway is checked too soon, or too late, is not a pretty landing, but it is better to check it too soon, rather than overrun. A little experience will show when to slow, in making the approach, when to stop, and when to reverse. For example, a certain type of boat, making a straight or parallel landing, may have the engines slowed to one-third four lengths away, stopped when stem is one-half length from where stern is to be, backed two-thirds when stern is half a length from its proper position, and engines stopped when headway is nearly checked.

The effect of the wind should be carefully studied. If wind is quite fresh and parallel to the dock or ship you are going alongside of, be sure you do not get your bow canted either way. If bow is canted outward, it will be nearly impossible to make a good landing. If is canted towards the dock or ship you run serious risk of doing damage. This is the most frequent cause of damage to other destroyers and your own. For the wind blows the bow in more and more, and if headway is still carried, the anchor or bill board will make a clean sweep of your neighbor's stanchions. In some cases, if you back hard enough, the stern may go in and the bow out, due to pivoting, but more likely the bow will come in, you will gather sternboard, and your neighbor will be raked worse than ever. And you may leave your anchor on her whaleboat davits. Best thing to do is not to at-

tempt to get out clear. Use the engines to stop headway, get out some lines *quickly;* hold her there and let her swing parallel. This will localize the damage, at any rate. Then you can tell your brother captain you will send your blacksmith and carpenter over to repair the damage. This last is an important bit of etiquette that should not be forgotten by young destroyer skippers!

The effect of the wind is strongest when the ship is backed, and is most marked in the 700- and 750-ton classes. They will back dead into the wind. The bigger boats tend to seek a heading with wind on the quarter. This is due to the high forecastle of the former; while the latter have boat skids or other top hamper more nearly amidships. In narrow quarters it is very dangerous to lie dead in the water with wind abeam. You should have room ahead, for if you try to twist her without getting way on, you will be confronted with a wearisome and often impossible task.

If the wind is onshore, be sure and keep well off, and keep the bow a bit further off than the stern, as the bow will come in much quicker.

If the wind is offshore, a certain amount of speed is necessary in order to make a good landing, and springs must be used. A method of coming alongside under such conditions when a parallel approach is impossible will be treated later.

The current will not have the effect of the wind in blowing off the bow, but it plays an important part, and often is not setting the way you think it is. It is especially difficult to judge when making a slip, for the chances are the current is *nil* inside the slip, or there even might be an eddy current inshore, opposite to the direction of the current offshore. The coal slips at the navy yard, New York, the slips at the torpedo station at Newport, and the old dock at Pensacola, are examples of where eddy currents may be encountered. Careful judgment and experience are necessary.

The question of what the ship will do with one or both screws astern is not well understood by many captains, and a better knowledge will not only avoid damage by knowing when not to back, but also knowing how to back may give one the opportunity to make some very pretty landings.

Always leave the dock or ship by going ahead if possible. The ship is under much better control when going ahead, and the engines are better able to give you what you want. If you back

away, the bow may pay off toward the dock or the vessel alongside, for, as has been remarked, the ship is more at the mercy of the wind, etc., when backing than when going ahead. Furthermore, the initial "kick" of the engines going astern may not be equal, causing the ship to cant one way or the other.

The "kick" comprises two elements: (1) The sidewise pressure of the blades deepest immersed (very noticeable when the screw churns on first starting); and (2) the pressure of the screw current on the hull. The first has the strongest effect and it diminishes when the ship gathers sternboard.

In going ahead you should not give much rudder to swing the bow out, for the stern will come in fast, and your propeller guard may leave a long mark on your neighbor. In some cases it will even be necessary to shift the rudder, to swing the stern out, in order to avoid fouling the anchor chain or buoy of your neighbor. If there is a slight tendency of wind or current setting you down on your neighbor, often a good bit of speed is necessary.

If conditions are better for backing, it is best to get away quickly in most cases, in order to obtain some steering effect of the rudder and to minimize the effect of the wind. If you are between two other boats, back both engines at a good rate, say two-thirds, or even full speed, to get the ship started. The wash of the screws will carry the sterns of both neighbors away and you will come away clean. Needless to say, slow down to a safe speed as soon as you are clear.

If the harbor is rather crowded, having backed away, but clear astern, it might be well to continue backing until you have plenty of room to turn. Only, be careful about crossing the bows of vessels at anchor. When going astern be careful how you use your rudder. A quick shifting of the rudder while you have sternboard may result in the rudder taking charge, on account of the pressure of the water on it, with a probability of a jammed steering gear, and perhaps a damaged steering engine.

Do not forget that when going ahead with full rudder you do not make ground to the side immediately. The ship, though turning, will range along its original direction of motion, and may even be set initially to the other side, due to the kick off of the stern, for the stern starts first, not the bow. We all know this truth, but occasionally forget it in the business of maneuvering.

In any maneuver try always to have an alternative in case your planned maneuver goes awry. A good habit of mind is to keep thinking, " Now if such and such a thing happens, what should I do?"

Under certain conditions do not hesitate to use an anchor to assist your landing. In a crowded harbor with a strong breeze or gale blowing, when you cannot get pointed into the wind to make a parallel landing alongside another boat, it is by far the best scheme to assist your turn by means of an anchor. Drop it so that you use as little scope as possible without dragging, and at such an angle as to be able to use it to keep the bow from crashing into your neighbor. Do not think it " bad seamanship " to use an anchor when it will prevent damage.

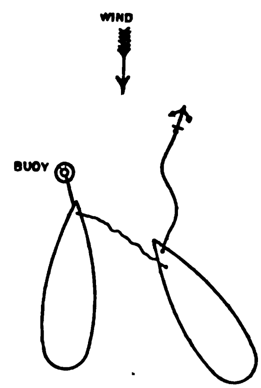


DIAGRAM B.

Diagram " B " shows that it is possible to use anchor and bow line to assist in turning by heaving in or checking both judiciously, at the same time using the engines to assist in turning. Be careful not to drag the anchor. This is most likely to occur when the ship is broadside to the wind. It is better to veer somewhat at that time and heave in when the heading is about as shown in sketch. When the stern is in far enough, and your lines are out, the ship may be heaved ahead to break out the anchor.

One captain turned his ship by getting out a bow line to the stern of another boat, let the ship swing to the wind and current, cast off and came alongside very nicely.

Do not forget, too, that your ship does not handle the same in light conditions as she does deeply loaded. This will be par-

ticularly noticed if there is any wind; your leeway will be greater in light condition.

SPEED

By speed is meant actual way through the water. You may often signal full speed on your engine-room telegraphs, if it seems best, but do not continue it long enough to get up much speed.

Speed is a good thing to use, only, (1) when you have to, and (2) when you have lots of room. Even in these cases do not use more than necessary.

If something goes wrong in a crowded harbor, such as jammed rudder or engine disabled, you will be harder pressed to win through without damage, if you habitually use high speed.

The same reasoning applies, with more emphasis, in making a landing, especially alongside another boat, or when there is something ahead, as in making a slip.

The ideal way to make a landing is to use only enough speed to be sure your ship is under control. This speed will depend on circumstances, as some of the examples already given serve to show.

I have observed that the longer an officer commands a destroyer, the more he reduces the speed of his approach. Nearly every destroyer captain will remember a period in his career when he loved to make spectacular flying landings. Very likely he "got away with it," but with longer experience he grew wiser, and was content to play safe.

And in this connection, if you misjudge your landing and see that you cannot avoid hitting, be sure to get the way entirely off the ship if possible; get out a line and hang on until you have swung. If one destroyer noses into another in coming alongside, an attempt to twist her around will almost invariably result in scraping along leaving a long trail of devastation behind. If you see you are going to be set against the corner of a dock, take your damage in one place, rather than to extend it for 15 or 20 feet or more along the side.

POWER

Often in an emergency a captain may take half-hearted measures to avoid collision or damage. Or, in turning, he unnecessarily delays by use of too little power. If he were the only one

entering harbor it would not matter much, but usually boats will be entering harbor in divisions or flotillas, and others will be delayed. Most of us know how exasperating it is to lie to at the harbor entrance, waiting for the chap ahead to get straightened out and in his berth.

Inasmuch as most destroyers have plenty of power, it may as well be used, only be sure not to get too much way on the ship.

Thus in turning in a limited space, it is foolish to ring up one engine one-third ahead and the other one-third astern, when you have enough power to ring standard ahead and two-thirds astern, changing either engine if too much headway is obtained. Then you will get around quicker and the *speed* through the water will be no greater.

Here are two ways of handling the engines of a ship turning in a limited space, the methods of two different officers—and there are nearly as many methods as there are destroyer captains. It will be assumed that the ship is turning to starboard:

First Method.—Start with port engine two-thirds ahead, starboard backing two-thirds. Then do not touch starboard telegraph *at all;* vary port engine only, shifting it to one-third ahead or standard ahead as much as is necessary to keep from forging ahead or astern too much.

Second Method.—Starboard engine back one-third; port engine ahead two-thirds. When ship gains too much headway, shift to *two-thirds* back on starboard engine; *one-third* ahead on port engine. Shift to the original setting when you gather too much sternboard. Continue like this, making no other changes except necessary rudder changes. In this case the command may be simply "reverse." There is little possibility of giving the engine-room the wrong signals.

Take your pick, or choose your own method!

It must be clearly understood by the throttle men just what the captain wants when he rings the engine-room telegraphs. A certain go ahead speed should be established as a maneuvering "standard speed," say 18 knots (15 knots will probably be better for 750-ton destroyers). Then you have one-third speed, six knots; two-thirds speed, 12 knots; full speed, 23 knots (five knots greater than standard, which is often designated for full speed in destroyers).

It is more difficult to base backing speeds on revolutions, and most destroyers have designated *pressures* for one-third, two-thirds, and full speed astern. No arbitrary pressures can be given, but the backing pressures of the ship should be so arranged that with one engine backing one-third and the other ahead one-third, the ship will move very slowly ahead.

A very important point arises in this connection. The throttle men may do one of two things when a backing signal is received: (1) Open throttle wide so that gage registers the designated pressure immediately, then throttling to keep the pressure there; or (2) he may open it gradually until the gage registers the desired pressure.

Of these, to my mind, the first is preferable in maneuvering, though perhaps the second is better from an engineering point of view.

However, in maneuvering, the kick given by the engine churning when first started back is often of exceedingly great help to the ship handler, and that effect is greatest if the throttle is opened wide at once. Furthermore, the result of a given signal is more apt to be the same to-day and to-morrow, a most desirable thing. For if the engines perform differently at different times, when the same signal is rung, the captain will truly have a terrible task to "learn by experience."

Lack of Confidence

This hardly needs discussion, it is so evident, as in everything we undertake, that confidence is half the battle.

In passing, it may be remarked that of two officers of equal ability starting out with their first commands, if one has the luck to make a perfect landing under difficult conditions, on his first attempt, he will usually continue to make good landings; whereas the other may slip up, knock down a few stanchions, dent in his bow, or knock a hole in the dock, and it will take a long time for him to get to normal.

Use of Lines

It is not within the scope of this article to go into details of how to handle the lines under all circumstances. But the proper handling of lines in connection with the proper handling of engines and rudder is the truest test of a seaman.

The most useful lines are the forecastle spring and the after spring. Next to this a breast to the capstan, and a breast aft, the latter to be made fast only when the ship is sprung in, or worked in by the engines, to the proper position.

The main thing is to obtain intelligent cooperation between the captain and the officers or men in charge of lines. To this end the latter should be indoctrinated so that they will know what to do without the necessity of signals or of bawled out orders.

When a "parallel" landing is to be made, *under good conditions,* the smartest method is for the captain to hold all lines on board until the ship is nearly abreast her proper position (and nearly dead in the water), toot a whistle, throw out all lines simultaneously on this signal, order engines secured, turn over the securing of the ship to the executive officer—and go below.

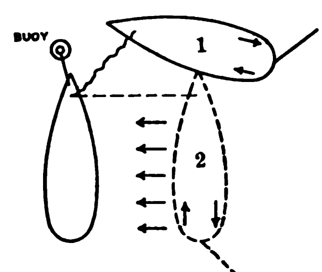


DIAGRAM C.—Port Screw Ahead; Starboard Backing; Rudder Full Right.

But when conditions are such that a certain amount of work must be done to get the ship alongside, the people handling the lines must know what the captain wants. An improper use of lines often will get things badly mixed up.

The following method of getting alongside a dock or vessel, when it is impossible or inconvenient to make a "parallel" landing, is especially good in landing when an offshore breeze is encountered. Having once tried this method the writer has used it continuously, and considers it a very pretty way of making a landing:

Proceed fairly directly to your assigned berth, and get your bow close enough to get out a line as in Diagram C, position (1). Keep this line entirely slack and twist the ship around to a heading parallel with the dock or ship with the engines, starboard

engine backing say two-thirds, port ahead two-thirds, and rudder full right. Change *one* of these engines in order to prevent going ahead or astern. It's easier to remember what you are doing if you only use one. When you are about parallel, (your bow will have paid off by this time) take line to the capstan and heave round. Then by proper manipulation of the engines (starboard backing, port ahead) and the line, the ship will breast bodily in crab fashion, and all that will be necessary at the last will be to get out more lines and secure. When you are parallel, the power of the engines must be reduced, as they kick the stern in faster than the capstan can pull the bow in. When about 10 feet away, stop everything, otherwise you will come in with a decided bump.

This same method may be used in getting away from a dock against an onshore breeze if there is a buoy or something to run a line to.

HANDLING AT SEA

This does not properly come within the scope of this article, and so will not be discussed at length. However, emphasis should be placed upon the tremendous amount of leeway a destroyer will make when there is a strong wind. If the wind is ahead your speed will be cut down a little, perhaps as much as 10 per cent in a strong breeze, and a great deal more in a gale. Most of this is probably due to the sea, however. With the wind about abeam or a little forward of the beam, you may find yourself 40 or 50 miles to leeward of your dead reckoning course in 24 hours. With the sea on the quarter, however, the ship will yaw so much, the stern being pushed to leeward, that the leeway may be counterbalanced, and you may even find that you have crept slightly to windward. No rules can be laid down concerning this, for it depends on the character and period of the sea, in addition to the strength of the wind.

With a rather heavy sea dead astern one would think the ship would be driven farther than the dead reckoning would give. This may often be the case, but to a much less extent than we would suppose. This may be due to the climbing up hill and down hill a destroyer would do under these conditions.

IN HEAVY WEATHER

Here are the different courses of action open to a destroyer forced to heave to in a heavy gale:

1. Head into sea, or with sea two points on the bow, at the lowest possible speed, lee screw making more turns than the weather screw, to keep the ship from falling off.

2. Take the position the ship would naturally take, engines stopped or moving slowly ahead.

3. Sea astern or slightly on quarter, "running before it" at fair rate of speed.

4. Sea astern or slightly on quarter, engines turning just enough to keep steerageway.

Every time two or three destroyer captains begin to discuss bad weather and how the ship should be handled in a hurricane, you will hear two or three different expressions of opinion, based on actual experience.

So my opinion based on experience in two well-known howlers, one January, 1912, 500 miles off the Atlantic Coast, the other in December, 1917, several hundred miles northwest of Cape Finistere, is only my opinion, and is in no way authoritative. And both times the boat was of the "flivver" type, *i. e.*, 700- or 750-ton boats. But it is believed that the same remarks will apply to the larger boats.

Now as to the *first course of action* (lying to, heading into the sea): With speed sufficiently reduced the ship will ride quite well, though pitching violently and occasionally taking a sea. If you head dead into it you are likely to duck under an exceptionally steep wave and ship a huge sea. It is better to keep about two points off. But it is necessary to maintain a certain amount of speed to steer, and the greater the force of the wind the greater the speed necessary. And the greater the speed, the more seas will be shipped, and the more the ship will pound. In my one experience of trying this method the ship was pretty badly damaged.

Nearly all the destroyers doing convoy work had broken frames forward, the result of pushing the ship against heavy seas. This is a different condition from that under discussion: the necessity of staying with the convoy in the war zone making it necessary frequently to steam into a sea at too great a speed in ordinary rough weather. But the same liability to damage exists in heavier seas and with more moderate speeds.

The *second course* (lying to in a natural position), while safe enough, as far as danger of swamping is concerned, is so utterly uncomfortable and hard on the personnel, due to violent rolling, as to preclude it from consideration, even if there did not exist the danger of rolling out the masts, smoke-pipes, and perhaps even rolling the boilers out of their saddles. As a matter of fact, destroyers have shipped heavy seas in this position. A sea sweeping across the deck of a destroyer is not a pleasant thing.

There remains, then, "running before it," and "lying to" with bare steerageway, sea astern or on the quarter.

Perhaps I have never given the former (running before the sea) a good trial. In the storm of December 17, 1917, on the *Reid,* lying to with sea astern, an increase of speed caused greater yawing, with threatened pooping, and we slowed down very soon.

We found it best to keep the sea a trifle on the quarter, in which position, with the use of oil, we rode beautifully. The ship yawed a bit, and the fantail was splashed with spray, but no dangerous seas broke on board. In some kinds of heavy seas, a destroyer can doubtless run at good speed, but I believe that, all things considered, it is safer when riding out a "storm sea" to steam as slowly as possible.

We tried heading into the sea, and did not fare very badly, but after shipping one or two seas it was decided to turn again, and keep the sea on the quarter.

With a destroyer there is no sense in waiting for a propitious time to turn, for a turn of 180 degrees in a heavy sea is a long operation. If done at slow speed, however, she will probably bob up over the sea like a cork, but she will be well shaken up during the operation, and there is always the danger of being swept by a sea.

The *Reid* sustained her greatest damage when speed was increased in order to turn and avoid a ship suddenly sighted a short distance ahead. This increase was from about six knots to about 12 knots. When the sea was nearly abeam, one wave swept over the deck, taking with it various items, such as boats, chests, potato lockers, etc., also, worst of all, our engine-room ventilators. A second sea coming over went down these openings, resulting in an engine-room half filled up, water entering lubri-

cating oil tank (having broken the gage glass) and directly afterwards hot bearings!

After this we had to keep the ship dry, and it was necessity that forced us to continue with the sea astern and continue using oil, which was of great value in preventing breaking seas.

Every destroyer captain should be very familiar with the "Laws of Storms," and should practice forecasting the weather. With Knight and the "Sailing Directions" for the particular locality at hand, one can develop into a first-class weather prophet, depending of course on your station, for the weather in some parts of the world is more difficult to understand than in others.

I have been told that a number of years ago two British destroyers went through a harrowing experience in weathering a typhoon in the China Sea. Their experience and lessons drawn therefrom were written for an English publication as being of great interest to the public, and especially to seamen.

But a careful reading of the article showed that these boats had entered the edge of the typhoon, had run out, and then were caught again when it recurved, this time passing through the center of the typhoon, encountering terrific winds and seas. The point of this is, that if they had been more familiar with the characteristics of cyclonic storms, they would have avoided the worst part of their experience.

An Example of Different Ways of Handling a Destroyer

Diagram "D" shows roughly the Anacostia and Potomac rivers, and the Washington Navy Yard. It was quite easy here to make a landing, but somewhat difficult to get away. Type of destroyer: Coal-burning, 700-ton type. The nature of her duty was such as to make it necessary to reduce the time wasted in mooring and unmooring to a minimum.

The ordinary method of "shoving off" depended on the tide. If it was ebbing, the bow was allowed to go out a little, engines started ahead, and when clear the ship was twisted around, ready to proceed down the channel. If on a flood tide, the stern was allowed to go out a bit, the ship backed clear and then turned. This was more difficult, and it was usually necessary to make a complete 180-degree turn, on account of the flood tide carrying the ship upstream. It must be remembered that this was a "700-

tonner", and required surging back and forth, shifting the rudder, and working pretty hard to get around. A "1000-tonner" would have had less difficulty in turning.

A better scheme was to wind the ship at the dock. This was not difficult, especially with a flood tide, for then the stem could

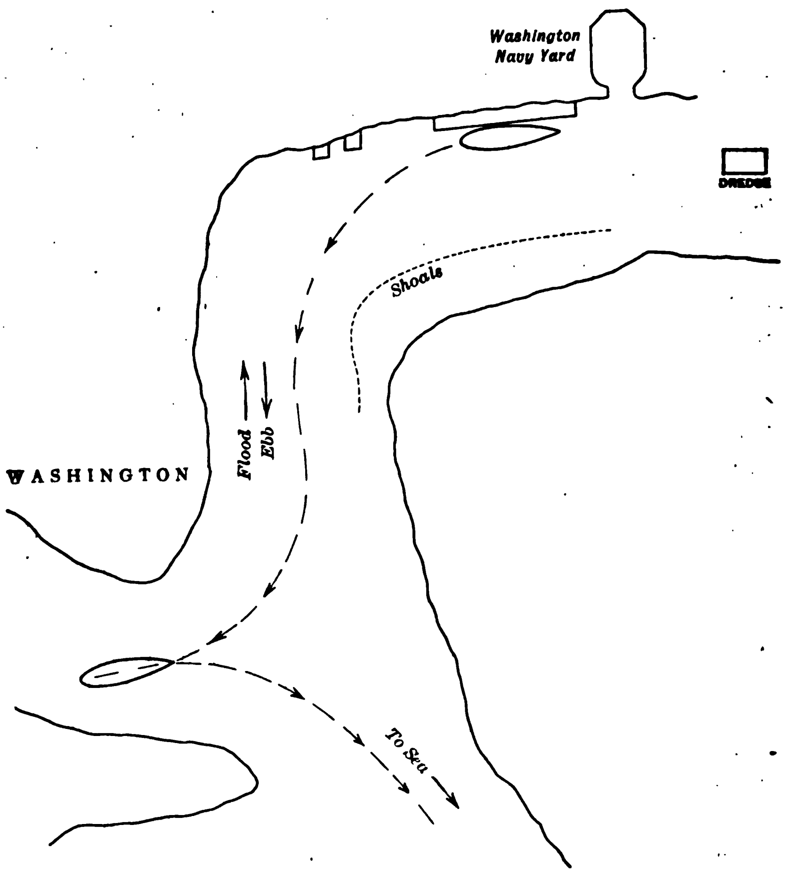


DIAGRAM D.—Potomac and Anacostia Rivers, Showing Navy Yard.

be held fast against the dock, until nearly around, then the ship backed enough to clear before going ahead.

With ebb tide it was not difficult, except that more care had to be taken to keep the propellers and rudder from touching the dock. In general, the current did practically all the work in this case, the engines only being used to keep the stern clear of the dock.

The next method tried was to wind the ship upon arrival. Coming in on a flood tide, the stem was placed against the dock and held fast, the tide, assisted by "twisting" with the engines, turning the ship end for end. This permitted a "clean get away," when it was time to go.

The last method was to back away from the dock, and, steering by engines and rudder, backing into the Potomac River, where it was only necessary to go ahead and down the river. This is shown by dotted lines.

These various operations were timed, and it was found that the last method saved several minutes.

CONCLUSION

Most of the foregoing remarks on the handling of destroyers are concerning "the little things that everybody knows," but in nine out of ten cases of damage or poor ship handling these little things are responsible. This article is not based on theoretical considerations, but on actual happenings.

It need not be assumed that a destroyer captain must analyze the forces at work while he is maneuvering his ship, or to have any "rule-of-thumb" methods. More likely, if he has gained some degree of expertness by practice, he will develop a sixth sense; he will handle the ship by the "feel" of it, as it were.

It may be remarked that in handling a destroyer it is best to take station where you can see the water close to the side. In this way you can judge your speed much better than by watching the beach or another ship.

Finally, be sure to give your junior officers, especially the executive officer, a chance actually to handle the ship under good conditions. In this way they, too, will get the "feel of the ship," and when the necessity comes for them to handle the ship in your absence they will have some degree of confidence to help them.

Remembering that there are many different ways of doing it, do not insist on their doing it exactly your way, and do not "butt in" except to avoid disaster. It is much better to talk over the whys and wherefores afterwards. I doubt if even the most phlegmatic "mate" could do well under the fire of his captain's criticisms.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME NOTES AND SUGGESTIONS *IN RE* NAVY PAPER WORK

By Lieut. Commander F. Welden, U. S. Navy

After reading Admiral Fiske's article entitled "The United States Naval Institute" in the February issue, 1919, I am prompted to burst into song on the subject of naval paper work.

My first experience in navy paper work was some years ago on a beef boat where I was acting gunnery officer of a small battery and it was necessary for me to make all reports without the aid of a regularly assigned yeoman. This work by the way was terminated by turning in all gunnery department stores and most of her battery to the navy yard when the ship went out of commission.

My experience while on this job led me to believe two things; one of which was, that the reports were so detailed and so numerous that large inaccuracies could be submitted without being detected and corrected. I make this statement because, as I discovered, there had been many erroneous reports submitted and I suppose I added to them, without, to my knowledge, anyone getting called for them. The other observation was that in my acquaintance with ordnance forms I found that the man who proofed the print had never been guilty of ever making up one of these forms on a typewriter, since they oftentimes have to be put in a machine three separate times to get the data on them in the proper place and at that the numbers involved very often run over in the next column.

After this first experience with paper work I had no further details which involved making reports except such things as hull boards, surveys, court martials, etc., until four years later, when I was ordered to a naval base which had been established during time of war and about three months previous to the signing of the armistice.

Needless to say that under these circumstances, with almost all the officers, reserve force and the same with the enlisted personnel, the paper work was far from pure. Unfortunately my experience had only been that previously related and I was handicapped, but I wish to make the following observations: I believe that the most serious fault with navy paper work at present is, that even officers of considerable experience and frequently of lengthy service had depended too much on the old-time chief yeoman and as a result, things which should be clear enough to anyone of any intelligence and average experience are often very hazy and cloudy, since up-to-date publications and instructions have not been issued, such as the yearly rules for battle practice.

Under this heading I should like to note that I believe as a "First Aid" the navy must have a standard method of correspondence based on battleship organization and expanded or contracted for other ships and stations as the case may be. This is undoubtedly contemplated in various rules for correspondence and instructions, but is not printed to the best of my knowledge in such form that any officer or yeoman can have a copy at any time he wishes it.

If standardization is worth anything at all, it is believed that navy paper work should surely be standardized and to this end there should be a standard system of procedure of correspondence involving at least the following:

(a) Each ship and station in the navy should have a central filing and mailing room.

(b) All incoming and outgoing mail should pass through this department with the possible exception of medical and supply correspondence not pertaining to the other offices aboard ship or station.

(c) Every department of a ship or station should be given a file letter, much the same as a fire control circuit is assigned letters.

(d) That a universal set of file numbers be adopted.

(e) That every letter coming to and from a ship or station be made a matter of record, and copies retained in the central file, except routine correspondence not necessary for record.

(f) That a cross index system in connection with the files be adopted on each ship and station and each letter cross indexed under as many subjects as possible in order to facilitate the accessibility of all letters on file, and likewise all Bunav. Circular Letters, Alnavs, Alatlantics, etc.

(g) That every ship and station adopt a color system of paper, such as; original—white, file copy—green, desk copy—pink, tracer copy—yellow. The file copy is to be retained in the central files on each ship or station, pink copy to be retained by the department of origin for a desk copy, yellow copy to be retained by the central files if a reply is necessary.

(h) That the central filing and mailing room number consecutively all outgoing correspondence, keeping a record of it in the outgoing mail book.

(i) That all correspondence show an initial letter of the department of origin and the initials or sign of the yeoman preparing the same.

(j) That the distribution be shown on all copies. This to include all printed forms.

(k) That all correspondence show immediately following the office letter and yeoman's sign the date when a reply is expected or (O) meaning no reply is expected.

(l) That the month shall not be numbered in any correspondence, but will be abbreviated as, Jan., Mar., since there is a great deal of confusion resulting from placing the day of the month before the number of the month.

(m) That the file copy shall at all times be a *signed copy*.

(n) That every signature should be written out on a typewriter, including the original, so that anyone who reads may know whose name it is.

It is believed that if a survey be made to determine the number of obsolete forms now in use that a considerable number could be done away with absolutely and that others could be revised so that one form would answer several purposes. While on this subject it is earnestly requested that all forms be made up to be filled in with a typewriter and as nearly as possible should complete the action by the use of one form. This would tend to reduce the number of signatures required such as, at present, on misconduct reports involving a loss of pay, which required seven signatures from the commanding officer, two from the executive officer, two from the medical officer and one from the supply officer, making a total of twelve signatures from officers that should ordinarily be engaged in more profitable work. To be of real value forms must be easily understood and should be complete in themselves, but need to be constantly corrected and not allowed to become *obsolete*.

It is believed that the present enlistment and enrollment records should be made uniform. At present there are many different marks and modes of service records, including five different colors, which makes it rather confusing to any yeoman to discover whether he is proceeding according to the latest practice or not. In this respect it is suggested that color should show the new editions in which the latest instructions for keeping enlistment records would be found. It is suggested that the present enlistment and enrollment records are not entirely satisfactory and it is believed that a loose-leaf system could be inaugurated so that the records would be of more value than now,—mostly a conduct report. Surely a man's photograph should be carried in his record, and that there should be some place in the record whereby the duty actually performed by the men should be entered, whether it be captain of the head or swabby of the lower deck. This can probably be accomplished by a skeleton record or a part of the loose-leaf record in the hands of the division officer.

After looking over a great number of service records that have been kept under various circumstances and various conditions at this base, one is not surprised to see records which contain no entries whatever for a period of six to eight months, except possibly the time of transfer, although even this is frequently omitted. The present records are full of Ts, Rs and CRs and "Less Than One Month," but it fails to show the time of reporting for duty even though the time of transfer may be a long period. Numerous places in the record which require entry for special reasons, such as conduct, leave, other misconduct and checkage of pay are a direct invitation to *inaccuracies* in records.

It may be pertinent to suggest the questions as to whether or not the present system of carrying men's accounts is the best. Would it not be possible to give the man a book in which the government enters an account, the same as a bank and from which he can write checks and present them for payment at any time during office hours of the supply officer.

While on the subject, it is believed that something should be done to allow officers and offices to keep up to date on Alnav. messages, Circular Letters and General Orders, which it is suggested should be published at least quarterly and a complete edition should be sent out yearly. Bureau of Navigation Annual

Circular Letter consists of a great deal of information which is believed should be included in the order governing advancement in rating, which at present is G. O. 63, "Instruction on Board Ship." This General Order, however, is deplorably out of date and does not answer the requirements, especially for an emergency as has recently confronted the navy. There is entirely too much " A to N " and " N to Z " and not enough " how to do " and " Can you do? "

It is noted that electricians (radio), quartermasters, machinist mates, now have a letter to designate their specialties and it is suggested that a letter could be used to advantage in many more ratings, particularly the rating of yeoman.

It seems to be worth while to encourage men to qualify in more than one rating and a small amount per month for each rating in which they are qualified would probably prove a correct incentive. This should be especially valuable to different yeoman stenographers and would encourage officers in dictating rather than compiling.

In summation of the above it is believed that the best instructions now issued by the Navy Department are the rules for battle practice, which give instructions to all classes of vessels as to what practice must be held, how they are held and what reports must be made, and include a *sample copy* of each form that is necessary so that if for any reason the forms are not available an officer may study the sample forms and if necessary make up copies on a typewriter or have them printed. It is believed that if this can be done for such a thing as battle practice, it is feasible to issue a booklet, annually if necessary, on standard instructions for correspondence. Instructions as to procedure of transfer, receipt, checkages, sentences of summary courts martial, etc., and include a list by offices of all reports required or a reference with a copy of each report in this booklet.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE PRINCETON NAVAL UNIT

By REAR ADMIRAL CASPAR F. GOODRICH, U. S. Navy

This brief article is not designed to give all the details of the work of the Princeton Naval Unit, but only a few of them, thought to differ from those in other naval units, all of which latter were conducted on general lines laid down by the Bureau of Navigation. The members prosecuted the studies prescribed by the University faculty for the gaining of the degree aimed at individually, while the naval instruction and discipline were the care of the commandant. In my case, there was no commissioned officer to assist me. I was, however, allowed one chief yeoman. Fortunately for me, he was competent to conduct military drills, having previously had a long experience in these matters. Also, he was helpful in the routine of the office within the limits of his capacity and knowledge.

The theory of navigation, seamanship, ordnance and gunnery were taught by college professors of exceptional ability. Practical work in gun exercises and demonstration in ordnance fell to the lot of a keen chief gunner's mate after the somewhat belated receipt of the necessary material, including some machine guns and a 4-inch loading rifle. This man had the happy knack of enthusing my lads almost as much as if he had a 14-inch gun at his command. I wish to acknowledge my indebtedness to Chief Yeoman J. G. N. Mitchell and Chief Gunner's Mate W. F. Buckley for loyal support.

Professor A. G. Mayor, a nephew of the late Rear Admiral Louis M. Goldsborough, U. S. N., assisted by Professor R. S. Dugan, the astronomer, kindly assumed charge of navigation, for which task they are eminently qualified. As the former has for years cruised about the world in a sailing vessel, he was able also, to teach seamanship. Here he was helped by Professor

Ulric Dahlgren, grandson of the late Rear Admiral John A. Dahlgren, U. S. N. In Professor Dahlgren's veins runs hereditary salt water. Later, when some cutters and whale boats arrived, he greatly aided me in boat drills conducted, perforce, by myself.

Professor L. P. Eisenhart, the mathematician, handled the subject of theoretical ordnance and gunnery in masterly fashion, acting, moreover, as liaison officer between the university authorities and me. I may here remark that my relations with these authorities continued to the end absolutely flawless. These gentlemen did all in their power to facilitate my work, freely acceding to my every request. If they entertain towards me the same feelings of regard as I do towards them I shall have good reason to be proud.

My unit was comfortably quartered in dormitories hard by an office assigned me in the gymnasium. Thus they were accessible at all times for inspection and were close to the place of formation.

So much in the way of preamble.

Possibly, nay probably, my disciplinary methods will be regarded by the majority of my readers as execrable. I should welcome universal applause, naturally, but really I would not alter those methods by a hair's breadth to win it. I was trying an experiment. As the experiment succeeded perfectly, at least to my satisfaction, I am well content.

At practically the first gathering together of the unit, I addressed the members substantially in these words:

> You are training to become officers in the United States Navy. Absolute truthfulness and honesty in all your dealings is obligatory as well as diligence in your work, respect to your seniors, devotion to the service and an upholding of its traditions. I propose, with your permission, to treat you as officers. If, however, you compel me to treat you as school boys I am quite ready to do so; it all depends upon yourselves.

Therefore, when reports for some minor infractions of discipline were made to me, I adopted the rule of asking the man involved whether the report was true. If he replied that it was in error, I accepted his statement without question and dismissed his case at once. I knew instinctively that, if he lied, his colleagues would make his life very unpleasant. Should the report imply moral turpitude, I allowed him to select one judge, the battalion commander appointed a second and the two chose

a third. The court thus formed investigated the case and handed in to me its finding and recommendation. In one case, I was led to dismiss the man from the unit and transfer him to the nearest receiving ship. In another, although the lad was guilty, clemency and a chance to rehabilitate himself were urged. This plea was accepted with happy results.

Demerits I rejected as appropriate to primary schools, not to a class of officers. In lieu thereof, I sought a "punishment to fit the crime." For example, one lad, whose shoes were not polished, was directed to write me a report on the shoe blacking establishments of Princeton. This report was so well done, in such good spirit and with so delightful a touch of humor (he discussed the relative merits of Greeks and Negroes in this employment) that I sent it to the boy's father who enjoyed it as much as I. I may add that cases of unpolished shoes were conspicuously absent thereafter. If the average youth dislikes any one thing in particular, it is writing a report. The instance referred to had a widespread and salutary effect.

One member, given to repeated talking in ranks, heard this pronouncement: "Since you are so fond of hearing your own voice, you shall stand in front of your company and recite aloud the Star Spangled Banner." Needless to say there were no more complaints of this nature. Incidentally I may remark, that the National Anthem was memorized by all. Every now and then it was the password to liberty.

At the very first lecture, I spoke to the unit in somewhat this fashion: "I observe with great displeasure that some of you young gentlemen have failed to obey my order always to bring notebooks and pencils to every recitation. You will each therefore write me a letter explaining your neglect and you will include in your letter a résumé of the sermon preached yesterday in the College Chapel by President Hibben." The neglect mentioned was not repeated.

One lad had not made up his bed by the hour appointed. To him I remarked, "Is not this afternoon a half holiday?" "Yes, sir," was the reply. "Very well, then, you will have your bed made up and your room in perfect order by 2 p. m. You will report the fact to the officer of the day, who will inspect. If all is in good shape, he will immediately pull your bed clothes apart and turn your room topsy-turvy. You and he will repeat

your several operations three times." This remedy proved most effective. These specimens of disciplinary methods are taken at random from a number—fortunately not large.

At the outset, I warned my youngsters that I should ask them many questions which might at first seem childish and should make them do many things which they would think foolish, my object being to cultivate their powers of observation, adding that when any one of the unit, later, on joining his ship, should be noted as mentally alert to a marked degree, seeing at once what others only looked at and taking in everything in sight, he would at once be recognized as a "Princeton man." To this end I sent out four observation parties, one to each compass quadrant, nearly every afternoon to make a hike covering about five or six miles. On their return they would be quizzed somewhat after this manner: "What kinds of road did you go over? What kind of fences did you see? What trees along the road? How many cows, sheep, pigs did you see? What sort of teams did you meet? How was the wind blowing? What proportion of blue sky in tenths?" etc. Each man was marked on the Naval Academy scale according to his answers. Meeting a group, I would fire at them such puzzles as these: "How high is that tree? How wide this road? How long is the gymnasium? How far is it from this building to that? What kind of trees line such and such a path? How many haberdasher shops in the two blocks on Nassau Street facing the University? The lads never knew what was coming next and they were distinctly on their toes whenever I hove in sight. One instance is so amusing as to be worth the telling. A company was at rest on the drill ground beside the railway. Calling out of ranks some half dozen or so men, I told them that railway metal was graded by the number of pounds per running yard, that, the last time I had occasion to inquire into the subject, the heaviest rail rolled was 110 pounds but that doubtless the weight had increased since then. "Go over to the railway, look at the rails, return and give me your estimates of weight." This they did. I may say that their guesses were quite close to the real figure. Then said I to them, "If you had looked carefully you would have seen that the weight of each rail is stamped upon it." A more crestfallen lot it would be hard to imagine.

It is notorious that competent messengers are rare. Inattention or indifference is the cause. I instituted a training in this respect. For example, while the battalion was at rest, the captain of Company A would write a message, call up one of his men and read it aloud twice, slowly and distinctly. "Take this message to the captain of Company B." The latter would write the message *as verbally delivered*, and send the paper to the captain of Company A. This procedure was repeated all down the line. It was astonishing to note the errors at first made in this transmission, but these errors diminished rapidly with practice, even when the messages, at the beginning short and simple, grew longer and more complex. The lads developed closer attention as time went on. Of course they were marked for accuracy in this work.

Now what was the result of this unusual form of instruction? Several members of the Princeton faculty have told me that never has there been in this University so keen and mentally wide-awake a set of men as those of the Naval Unit. Again, the Professor of Architecture informs me that he has, perforce, to teach largely by means of photographs. [illegible] bring St. Peters in Rome or Canterbury Cathedral [illegible] [illegible] his class a whole year to learn [illegible] the men of the Naval Unit [illegible] It seems incredible [illegible] no substantial difference between [illegible] rest of the student body [illegible] learned the use of their eyes.

I have [illegible] the Naval Academy [illegible]

battalion commander, but as you know, you are too many and the time is too short. In a couple of weeks I shall appoint a new set of cadet officers, but as I am determined that none of you shall ever be able to accuse me of favoritism, of giving this inestimate opportunity of learning how to command to men I hold in special esteem, I shall put into a hat the names of those of the division now serving in the ranks. These names will be drawn by a disinterested person and a roster made absolutely by lot. There are fourteen cadet offices. The man whose name leads the roster will be the battalion commander for two weeks, the second the battalion adjutant, etc. At the end of a fortnight numbers 15 to 28 will succeed them, and so on to the end of the term. If any one of you fails to get a high place, do not blame me. I shall have given every man the same chance. Luck shall decide, for or against you." I have every reason to be satisfied with this innovation. Each man knew in advance the place he was to fill and sought to prepare himself for his duties. There existed a hearty sense of co-operation all round and there was no lack of snap in drills, for each endeavored to do even better than his predecessor.

One case is worth citing as illustrating my own attitude towards my men. A certain member, a thoroughly nice, manly chap who had drawn the lot of company captain, came to me and begged to be excused from that duty on the score of his lack of sufficient military training. This request I flatly refused, saying "Blank—you have an opportunity of showing to yourself and others of what you are capable, an opportunity which may never again come to you in all your life. Your friends in the first detail will tell you what to do. Put on a bold face and pretend you know the whole game. Never mind mistakes, we all are guilty of them. If I should relieve you now, in days to come you would never forgive me." Of course he made good and when later a chance occurred to prove his gratitude he seized upon it eagerly—but that's another story. Disappointment was doubtless experienced by some who drew the smaller prizes in the lottery, but all recognized the justice of the scheme.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

DROP THROUGH PUMP VALVES

By Commander Bruce R. Ware, Jr., U. S. Navy

The loss of pressure through the suction and discharge valves of the various pumps on board ship is not given sufficient consideration. As a rule, if a pump runs when steam is turned on and "really" *does* pump the water or oil as the case may be, it is taken for granted that everything is all right. It may be, however, that as high as a quarter of the power input is being used to operate the valves. The engineer officer who wishes to obtain

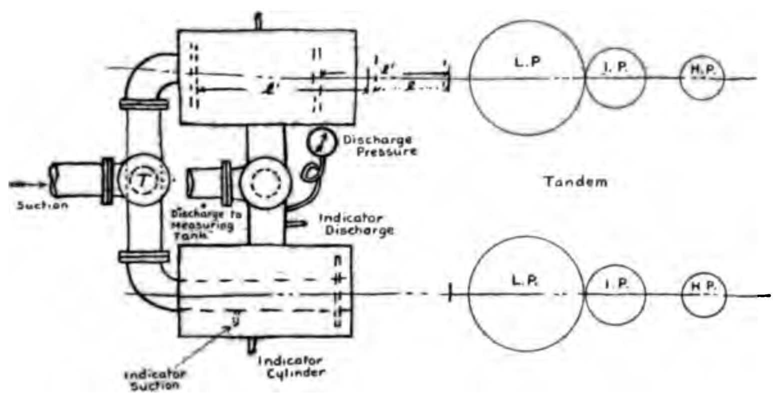


Fig. 1.—Test Layout for Drop Through Valves.

economy should become familiar with the pumping heads and pump speeds for his pump requirements in order that this loss of pressure may be reduced to a minimum.

The theory involved is simple: A pump, in order to receive water into its cylinder, must expend energy in raising the suction valves and in setting in motion the water in the long suction pipe. The pump has also to discharge the water from its cylinder and to do so it must expend additional energy in lifting the discharge valves. This expenditure of energy causes a decrease in the net work.

In studying this loss, an indicator diagram may be used to show the pressure inside the cylinder on the suction and dis-

charge strokes. In order to investigate the drop through pump valves an ordinary direct acting pump was rigged, as shown in Fig. 1. There was an indicator attached to each cylinder; one

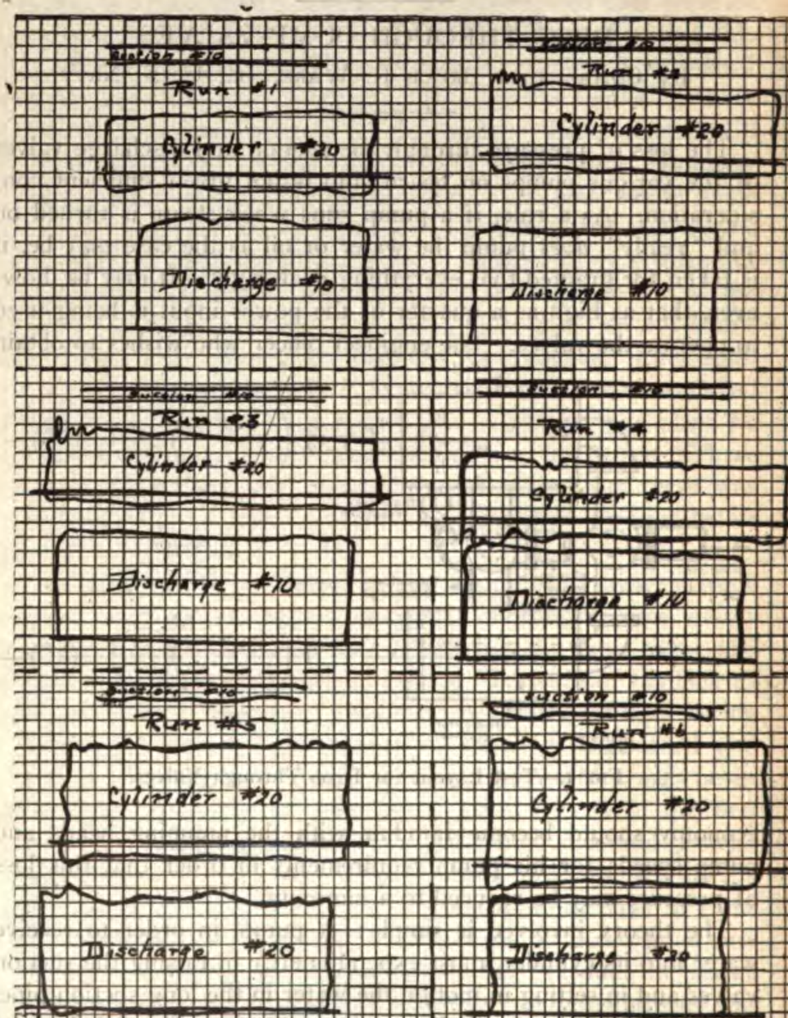


FIG. 2.

on the discharge and one on the suction. The indicator diagrams for six (6) runs are shown in Fig. 2. The test log record sheet is shown in Fig. 3.

No. of run	Time in sec.	Lbs. of water per sec.	Cu. ft. of water per sec. Q	Lbs. of water per hr.	R. p. m.	Length of stroke ins.	Pres. corres. to barometer #/□″	Suction pres. #s/□″ abs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	300	12.77	.204	46,000	6.0	11-9	14.80	13.6
2	300	14.93	.239	53,800	9.5	11-9	14.80	13.8
3	300	40.27	.745	145,000	17.0	11-9	14.80	14.0
4	180	71.00	1.135	255,500	27.5	11½-8	14.80	14.0
5	180	76.80	1.229	276,200	27.5	13-10	14.80	13.6
6	180	79.90	1.279	280,100	28.0	14-9	14.80	13.7

Cyl. pres. intake #s/□″ abs.	Cyl. m. e. p.	Disch'g m. e. p.	Drop suction valves #s/□″	Drop disch'g valves #s/□″	Drop suction valves in feet of water	Drop disch'g valves in feet of water	$\sqrt{2gh_s}$	$\sqrt{2gh_d}$
(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
13.0	14.8	11.7	.6	3.1	1.38	7.13	9.45	21.45
13.0	15.0	12.4	.8	2.6	1.84	5.98	10.90	19.65
13.0	12.6	11.4	1.0	1.2	2.30	2.76	12.40	13.35
11.7	10.3	9.8	2 3	.5	5.29	1.15	18.30	9.85
11.2	25.0	24.6	2.4	.4	5.53	.92	18.90	7.70
11.0	25.0	24.8	2.7	.2	6.22	.46	20.00	5.55

$\frac{Q}{\sqrt{2gh_s}}$ $=KA$ suction	$\frac{Q}{\sqrt{2gh_d}}$ $=KA$ disch'g	Combined losses %						Piston speed in ft./sec	No. of run
(19)	(20)	(21)						(27)	(1)
.0216	.0095	.84						.0833	1
.0219	.0121	1.00						.1320	2
.0520	.0483	.68						.2367	3
.0620	.1152	.79						.3718	4
.0650	.1596	.28						.4385	5
.0639	.2304	.16						.4480	6

FIG. 3.—Test Log Record Sheet.

Before proceeding to deduce results from the data recorded, it may be anticipated that for the case Fig. 1, the intake pressure should be lower than that of the atmosphere, due to the necessity of lifting the suction valves and to starting the flow. Work must also be spent in opening the discharge valves, so it may be expected that the average pressure discharge will be less than the mean effective pressure in the cylinder on the discharge stroke.

The amount of drop may increase or decrease with an increase or decrease in the speed of the pump, or vice versa. However, the faster the pump runs, the more continuous the flow of water into the cylinder and the less energy will be lost in moving the

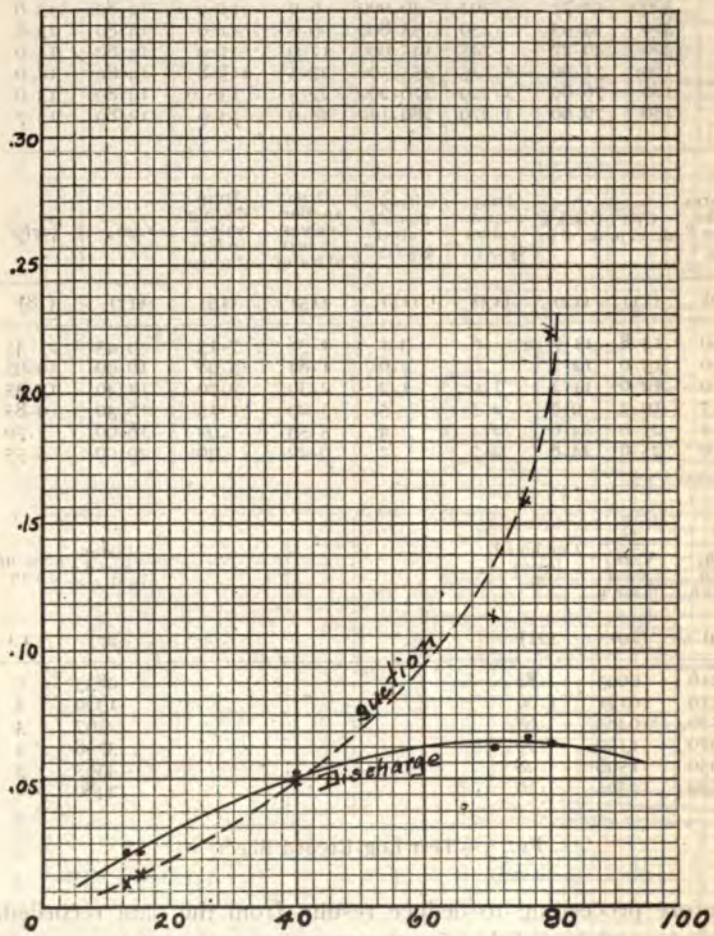


FIG. 4.—Pounds of Water per Sec.

column of suction. On discharge, the faster the pump operates, the larger the volume of water to be discharged, and this will necessitate higher mean effective pressures in both cylinder and discharge. In order to handle the increased volume as the pump

speeds up, valves must be worked faster, and as the valve seat area is a constant the amount of "lift" (opening) only need be considered. As volume has three dimensions it is seen that the opening will increase with the cube and the energy lost is proportionally less. The loss will be still proportionally less as the pump speed increases, due to the stroke of the pump being in feet and the valve opening being in inches.

In pumps where the valves operate against springs, the loss through them will be greater.

The amount of water discharged through an orifice is proportional to the area of the orifice, the velocity of the flow and the shape of the orifice. The equation $Q=K\times A\times\sqrt{2gh}$ shows this relation. Therefore, if the amount of water discharged by the pump, Fig. 1, is measured, Q will become known; by measuring the area of the valves A is obtained. It is now necessary to relate the factor $\sqrt{2gh}$ to the condition of a pump: the cylinder is full of water, the piston advances at a certain speed (this is piston speed in feet per second) and forces the water through the valves into the discharge line to the measuring tanks. The amount of drop through the valves is equal to the difference in pressure shown by the indicator diagrams obtained and will be the desired value of h.

The only factor in the equation that requires special consideration is the coefficient K. The type of valve, the length of pipe, the inside projections, are all factors which affect K. Its value should be determined for each pump on board ship by running a short test. To make the results of Fig. 3 general for use on board ship the relations will be calculated and plotted for a value of KA. The coefficient of discharge K may or may not be constant. For varying pump speeds it cannot remain constant for the amount of valve opening will vary.

The data on the test log record sheet, Fig. 3, is explanatory of the method of calculating results. The amount of water measured during the run is divided by the time of the run in seconds and the value of Q obtained. If the water has been weighed, dividing by 62.5 will give Q in cubic feet. In the test the temperature of the water was recorded in order to ensure using the correct value of the conversion factor. From the revolutions (6) and length of stroke (7) the average piston speed in feet per second (27) was

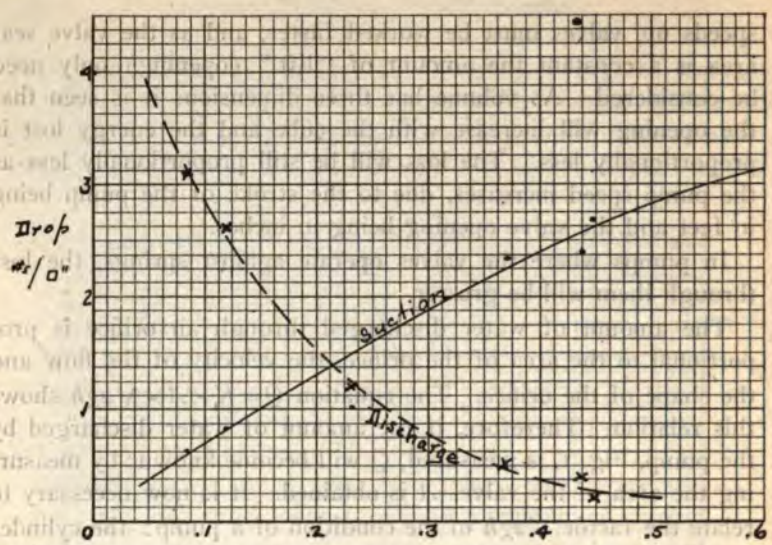


FIG. 5.—Piston Speed—Feet Per Sec.

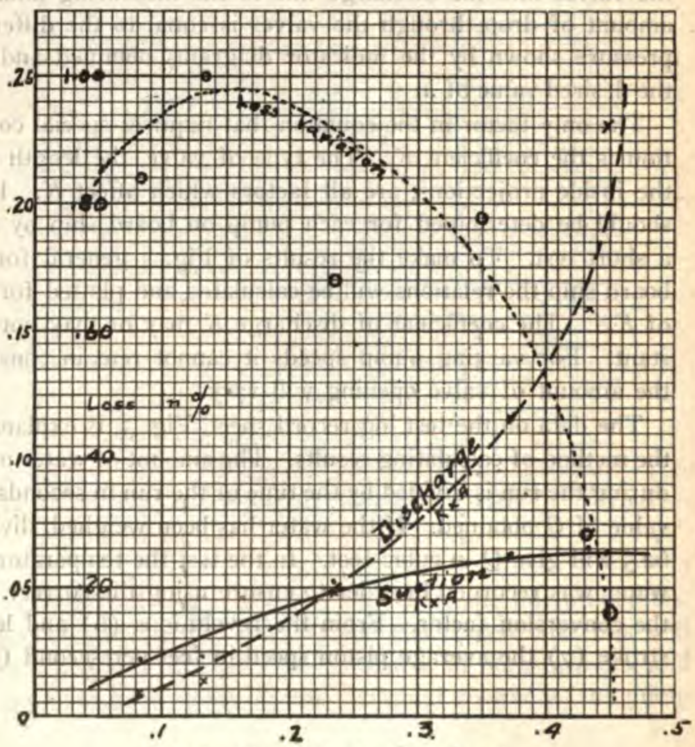


FIG. 6.—Piston Speed—Feet Per Sec.

calculated. The difference between columns (9) and (10) will give the amount of drop through the suction valves column (13) and that between columns (11) and (12) will give the drop through the discharge valves (14). Column (15) equals column (13) multiplied by 144 and divided by 62.5. Column (16) equals column (14) multiplied by 144 and divided by 62.5. The variation in the value of K is shown by plotting the value of $K \times A$ (square feet) as ordinates with pounds of water handled per second as abscissæ. This must be done for both suction and discharge. The drop through valves, varying with piston speed, is shown by plotting it against the piston speed. Assuming the area A to be one square foot the relation between K and piston speed may be shown by plotting.

A comparison of the plots of Figs. 5 and 6 shows that as the piston speed increases the value of K increases for both suction and discharge, but that the drop decreases through the discharge valves, and increases through the suction valves.

In Fig. 6, the curve showing the loss variation determines that the most economical operating speed of the pump was at full speed.

As the continual operation of any piece of machinery at high speeds—under overload, as it were—is expensive both in steam consumption and upkeep, wear and tear, it is not desirable to have the best valve operating point at speeds above the standard, normal load.

Therefore, the value of K should be made a maximum at the normal pump speed and this may be obtained by tight valves, proper type of valve, smoothing projections inside the piping and valves, and by a study of the piping. A gasket, for instance, if only partly trimmed inside will cause excessive suction losses.

Knowing, then, that K is at its maximum at normal loads, it is a simple matter to order the speeds at which an additional pump will be started to share the load. The efficient operation of the pump will save many a bucket of coal.

It is hoped that new methods of gun construction will so add to the battery power in the form of higher velocities that it will be a long time before the 16-inch gun must be supplanted by the 18-inch.

To revert to the question of speed, why is it we want none of the captured German ships? Because they have obtained speed at the expense of armor, battery, and steaming radius. If we now begin building 28-knot battleships, what are we to do with all our 21-knot vessels? Ten years hence they will nearly all be good ships and in case of war will be used. Let us continue as we have begun—build battle cruisers, scouts and destroyers for speed, but battleships, as Commander Eggert says, for the stand up and knock down fight.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Change in Board of Control

Captains W. H. Standley and J. G. Church, U. S. Navy, tendered their resignations as members of the Board of Control upon being detached from duty at the Naval Academy, and their resignations were accepted by the Board with regret on June 10, 1919. Captain W. T. Cluverius, U. S. Navy, was elected a member of the Board of Control.

Membership

Life, regular and associate membership, 5787. New members 21: Resignations 10.

Deaths:

Lieutenant G. C. Hill, U. S. N.
Lieutenant J. R. Cruse, U. S. N.
Mr. R. L. Bacon.

Dues

The annual dues ($2.50) for the year 1919 are now payable.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

Address of Members

All members are urged to keep the Secretary and Treasurer informed of the address to which PROCEEDINGS *are to be sent, and thus insure their receipt.*

Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 10th of each month.

Book Department

The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, 155, 166 and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 50 cents per copy.

ANNAPOLIS, MD., JUNE 15, 1919.

INFORMATION INDEX

PROFESSIONAL NOTES

PREPARED BY

COMMANDER S. A. TAFFINDER, U. S. Navy

GENERAL ARRANGEMENT

FRANCE

AMERICAN-BUILT LAFAYETTE WIRELESS STATION IN FRANCE.—The sale of the great Lafayette wireless station at Bordeaux to the French Government at a price of approximately $4,000,000, and many hitherto unpublished facts of American naval activities in the war, were announced recently by Assistant Secretary Roosevelt. "The great Lafayette radio station near Bordeaux was intended to insure communication between Washington and the army and navy, in case the cable system was put out of commission or interfered with by German submarines," Mr. Roosevelt said. "It has eight towers and could communicate with the United States day or night. It was built by the navy. I arranged with the French Government that we shall complete the station, which is two-thirds finished, and they will then take it over at what it costs us, about 22,000,000 francs."—*Scientific American*, 5/24.

LOSS OF SUBMARINES.—Severe weather caused havoc to the eight ex-German submarines which were being towed from Harwich to France, seven of them being lost in various ways. Two parted their tow near Beachy Head, one driving ashore and the other having to be sunk by the destroyer *Francis Garnier*. These boats were part of a group of 32 which have been allotted to France.—*London Army and Navy Gazette*, 5/3.

FRENCH NAME DESTROYER FOR QUENTIN ROOSEVELT.—The only French war craft named after a citizen other than France, is the torpedo-boat destroyer *Quentin Roosevelt*, named recently as a mark of respect to the late ex-president and his son. The destroyer is the former Russian *Buiki*, which has been taken over by French naval authorities and renamed. She was rechristened last September. The *Quentin Roosevelt* was turned over by the Russians to the French because their navy was at that time short of men and they were unable to man her.—*Naval Monthly*, June.

SCHNEIDER MARINE TYPE DIESEL ENGINE.—The most recent design of naval Diesel engine produced by Schneider et Cie, France, has an output of over 2000 i. h. p. from eight cylinders, and is giving good service in the French Navy. Details of the design are quoted from *Motorship*.

The official rating of this new engine is 1450 b. h. p., at 330 r. p. m. from eight single-acting cylinders, each 410 mm. bore (16.1417 in.) by 450 mm. (17.7165 in.). The length of the engine over-all is about 30 ft., its height from bottom of bed-plate to top of valves between 9 and 10 ft., and its width equally moderate, being about 4 ft.

The engine is of the valve-in-head scavenging two-cycle type, with trunk pistons. These pistons are made in two parts, the upper part being of steel, and is oil-cooled through telescopic tubes, these having knuckled joints. At the forward end of the engine are three combined scavenging-pumps and air-compressors, and these are driven directly by the crankshaft. Between the forward cylinder and the air-pumps is arranged the vertical shaft that drives the cam-shaft and the governor. There are four scavenging-valves per cylinder.

The engine has been made direct-reversible with the idea that a submarine when carrying out necessary maneuvers can go alongside the dock, etc., without utilizing the electric motors. But, of course, with a Diesel-electric driven cargo ship the engines could be reduced in first cost by dispensing with the direct-reversing astern motion.—*Gas and Oil Power*, 4/3.

GREAT BRITAIN

THE RENOVATION OF THE NAVY.—That the close of hostilities would witness a drastic weeding-out of inferior material was foreseen by all who are conversant with naval affairs, but it is doubtful whether many were prepared for such a comprehensive clearance as the Admiralty has announced. Upwards of 170 vessels, condemned as no longer effective, will be put up for sale as soon as they have been stripped of their guns and movable equipment. As a study of the list reveals, the effect will be to place the British Navy on a purely dreadnought footing so far as its capital units are concerned. Since the original dreadnought was laid down in 1905, it has taken only 14 years to complete a revolution quite as epoch-making as was the transition from wooden three-deckers to ironclads in the middle of last century. Very early in the war it was realized that against ships of the all-big-gun type the best pre-dreadnoughts were worse than useless, being mere death-traps for brave men. For a time our margin over the enemy was not large enough to allow us to depend on dreadnoughts alone, but as new ships passed into service the pre-dreadnoughts were detached from the Grand Fleet and employed on subsidiary operations. Their weakness lay in the low power of their armament and in their vulnerability to gun-fire and underwater attack. They added little or nothing to the real strength of the navy, and no useful purpose would have been served by keeping them on the active list. Hence the admiralty's decision to repeat the "scrapping" operation which Lord Fisher initiated when he became First Sea Lord in 1904.

Practically every battleship class anterior to the dreadnought is represented in the list, the only exceptions being the "semi-dreadnoughts" *Lord Nelson* and *Agamemnon*, which are to be retained in service as part of the reserve fleet. Of the eight ships of the *King Edward* class, two were lost in the war; the *Africa, Dominion*, and *Hindustan* are to be disposed of, and the remaining three are now employed as depôt ships. When completed in 1905-06 these vessels were considered almost the last word in battleship design, and together they formed the finest homogeneous squadron in the world. They were the last ships to be designed by the late Sir William White. Another noteworthy class disappears completely with the sale of the *Albemarle, Duncan*, and *Exmouth*. Originally there were six of these ships, comprising the *Admiral* class, but the *Montagu* was wrecked

in 1906, and the *Cornwallis* and *Russell* were sunk in the war. Having an extra knot of speed and thinner armor than contemporary battleships, they have some claim to be regarded as forerunners of the battle cruiser. Further down the list are ships of the *Queen, Formidable, Canopus*, and *Majestic* classes, all famous types in their day. Of the *Majestic* it may be said that she set the fashion in international battleship design for 10 years. The *Redoubtable—ex-Revenge*—sole survivor of the old *Royal Sovereign* class, is now marked down for sale after a varied and useful career which began in 1892. She was the only representative of her class to take an active part in the war, being attached to the "scratch" squadron which bombarded the Belgian coast in 1914. Our armored cruisers suffered heavily during the war, and the fighting value of those that survive is small, but as they are useful ships for training and other peace duties, the majority of them are to be retained. The most modern cruiser on the sale list is the *Duke of Edinburgh*, completed in 1906. She was never a successful ship, her free-board being so low that the 6-inch guns on the main deck could not be fought in heavy weather, and her speed of 22.8 knots was quite inadequate. Her Thames-built sister ship, *Black Prince*, was sunk at Jutland, together with the *Defence* and the *Warrior*. It is now generally admitted that the construction of these large cruisers, which were deficient in speed, protection, and gun power, was a costly mistake; yet the design of the *Effingham* class, now building, indicates a reversion to this dubious type. The *Effingham* and her sisters are of 9800 tons, and are expected to attain 30 knots. The armament consists of seven 7.5-inch guns, and, as they are coal-burning ships, the complement will be very large. It is certain, therefore, that they will be expensive to maintain in commission. The armor protection—as noted in Sir E. Tennyson d'Eyncourt's recent paper—is so meagre as to be practically non-existent, and the ships will thus be unable to withstand heavy punishment. On the whole the *Effingham* does not appeal to us as a type which it is desirable to multiply, even if it is deemed expedient to finish the first four, only one of which, we understand, is nearing completion. The older armored cruisers, viz., the *Drake* and *Cressy* classes, are to go, together with most of the protected cruisers launched more than 15 years ago. In the ordinary course of events the majority of these vessels would have been scrapped before now, but during the war they proved extremely useful for patrol and convoy work. Now that the emergency is over we can afford to dispense with them, more especially as we are well provided with modern light cruisers, of which we possess about 70, with speeds of 25 knots and over, besides several others under construction. In no category is the process of renovation to be more drastic than in that of destroyers. Over 100 of these vessels are to be withdrawn from the active list, and, generally speaking, all boats above 10 years of age are to be disposed of. They range from the earliest "30-knotters" to the comparatively modern *Tribal* class, built in 1906-1910. It goes without saying that after the tremendous strain of four and one-half years of war service most of our older destroyers would require a thorough refit—including new boilers, and in some cases new machinery—if they were to be of any further use, but it is equally clear that they are not worth the heavy outlay their renovation would involve. Thanks to our huge war programmes, we have an abundance of modern destroyers, so that the bulk of our older material can be sacrificed without a qualm. It is further proposed to get rid of all the torpedo boats, with the exception of the 30 odd oil-fired turbine boats built as "coastal destroyers" in 1906-1909, and 21 are to be sold immediately. Among the submarines ear-marked for the ship-breaker are most of those composing the *B* and *C* classes, which have ceased to be effective. It is interesting to note that several of the *B* class were converted into surface patrol craft during the war, their electric motors being removed.

From the foregoing account it will be seen that every class in the navy, excepting dreadnoughts and battle cruisers, is affected by the "combing-out"

policy which the Admiralty has decided to apply with such vigor. The result will be to disburden the establishment of a great mass of material the retention of which, while it would contribute nothing to the real fighting strength of the navy, would represent a heavy charge on the national revenue. To the average layman a warship is a warship whatever its age or condition, and it is possible that the public may suspect the naval authorities of going too far in their zeal for economy. For that reason it is desirable to emphasize the fact that few, if any, of the vessels now on the sale list could be usefully employed even if hostilities broke out afresh in the near future. There is no question of weakening the navy. On the contrary, the navy will be all the stronger when it has been disencumbered of so many third-rate ships that absorb men, money, and labor out of all proportion to their fighting value.—*The Engineer*, 5/16.

MORE LIGHT ON JUTLAND.—A review of Lord Jellicoe's book, *The Grand Fleet*, by Vice-Admiral Paul Behncke, is chiefly interesting for the remarks that officer makes upon the Jutland Battle. He was present at the battle as Commander of the Third Squadron of the German Fleet, with his flag in the *König*, the most modern battleship on the enemy's side, and the leader of the German battle line. It is, therefore, an opinion based on personal experience when he states that the performance of the British ships on the day of the battle was admirable. He goes on to speak of the handling of the fleet at night as faulty, "being far below the high mark made by the Grand Fleet in the day-time." He has this much of justification for his view, that the German ships were able to escape during the night and seek safety in their ports. When, however, he asserts that owing to faulty disposition the British Admiral was only able to reassemble his force on the evening of the following day, he is quite at variance with the facts, for at 4.10 a. m. that morning the Battle Fleet was formed into divisions in line ahead, at 5.15 a. m. the Battle Cruiser Fleet rejoined in accordance with orders and it was not until 7.15 a. m. that the course, was altered to north, and at noon that the decision was arrived at for the whole force to return to its home ports. The further remark of Admiral Behncke that at daybreak the German High Seas Fleet was collected ready to resume the fight is equally devoid of truth.

This Paul Behncke is presumably the officer who, as a captain at the beginning of the war, described himself in the German naval communications as Departmental Chief of the Naval Headquarters Staff. He may have been, and apparently was, acting as the mouthpiece of von Tirpitz, and his immediate superior seems to have been Vice-Admiral H. von Pohl, who also signed some of the official *communiqués*, particularly that which notified the first submarine blockade. But it was Behncke's business to put out the fabrications intended to mislead neutrals, and to impugn the honesty and trustworthiness of the British official communications. He it was who endeavored to excuse and extenuate the bomb-dropping of the German airships in January, 1915, on Yarmouth, Cromer, Sheringham, King's Lynn, and other places—although this was among the less flagrant of his efforts at misrepresentation. The most notorious was his version of the sinking of the *Lusitania*, in which he suggested that the speedy destruction of the ship must be attributed to the large quantities of ammunition on board her. If, as was probably the case, he had a hand in the semi-official statements which were put about in Germany, he was also responsible for the allegation that the *Lusitania* was practically an auxiliary cruiser, and that it was necessary to torpedo her without warning, otherwise she would have sunk the submarine. If the assumption is correct, that the Captain Paul Behncke of the Admiralty Staff is the Vice-Admiral Paul Behncke who now reviews Lord Jellicoe's book, he probably went to the High Seas Fleet when von Pohl succeeded von Ingenohl, and the Grand Admiral fell into disgrace. This would explain why he seeks to find excuses

for the policy of von Tirpitz and the action of the German Naval Staff, with which he was so intimately connected.

Fortunately, no one need rely upon German versions of the warfare in the North Sea, or upon the jaundiced views of a defeated enemy. This week there has been published a book, the first of its kind, which, without flattery, may be said to be the complement of Lord Jellicoe's volume. It contains the impressions of a naval lieutenant who served in the North Sea during the four years of the war, for the greater part of the time in the *Southampton*, one of the hard-worked light-cruiser class. Apart from the most interesting description which he gives of the ordinary routine work of the cruisers in all weathers at sea and in harbor, the author's personal records of what happened within his own knowledge at Jutland sheds new light upon several important phases of that battle. He prefaces his chapters on this subject by saying:

"I was by the chance of war placed in certain positions, at certain times, in such manner that in looking back on the action I do not believe that a single observer could have seen more, except from an aeroplane. Most of the time I was engaged in taking notes, and it is of what I saw that I propose to write. It may thus be accepted that, unless otherwise stated, the incidents described are facts for which I am prepared to vouch to the extent of my belief in my own eyesight."

The *Southampton*, it will be remembered, was flying the broad pennant of Commodore W. E. Goodenough, commanding the Second Light Cruiser Squadron. This squadron was scouting on the southern end of the screen before the Battle Cruiser Fleet under Sir David Beatty. The author describes the sighting of the enemy, the opening of the action, and how he witnessed the destruction of the *Indefatigable* and the *Queen Mary*. Later on, it was from his ship that the High Seas Battle Fleet was first sighted, and the *Southampton* got near enough for the author to count 16 or 17 battleships, with the four *Königs* in the van and the six older pre-dreadnoughts in the rear. He has an interesting reference to the clever manner in which the navigator of the ship evaded the shells from the enemy battleships by zigzagging the *Southampton* according to where he estimated the next salvo would fall. He witnessed the destruction of the *Defence*, the amazing career of the *Warspite*, the deployment of the Grand Fleet, and the manner in which the Germans managed to get away as soon as they realized the peril of their position.

It was in the night action that the most trying ordeal of the *Southampton* occurred. A vivid picture is drawn of the nerve-racking experience which this proved to be after officers and men had already endured nearly nine hours of battle. Out of the darkness five ships suddenly appeared, and from their faint silhouettes it was impossible to discover more than the fact that they were light cruisers.

"We began to challenge; the Germans switched on colored lights on their fore yardarms. A second later, a solitary gun crashed forth from the *Dublin*, which was next astern of us. Simultaneously, I saw the shell hit a ship just above the water line, and about 800 yards away. As I caught a night mare glimpse of her interior, which has remained photographed on my mind to this day, I said to myself: 'My G——, they are alongside us!'"

The action which ensued lasted 3½ minutes. The four leading German ships concentrated their lights and guns on the *Southampton*. In those 3½ minutes, she had 89 casualties, and 75 per cent of the personnel on the upper deck were killed or wounded. The range was amazingly close—no two groups of such ships have ever fought so close in the history of this war. After describing how the guns in his control aft were put out of action because everybody was killed except the sergeant major and himself, and how with the assistance of a steward he managed to put out a fire which had ignited half a dozen rounds of cordite, he says:

"Then it became lighter than the day. I looked forward. Two pillars of white flame rose splendidly aloft. One roared up the foremast, the other reached above the tops of the second and third funnels. This, then, was the end! The heat warmed the cheek. It was bad luck, just after we had got the small fire aft extinguished. But there could be no doubt; the central ammunition hoist was between those two funnels. What was it going to feel like to blow up? . . . . Might as well take one's great coat off, just in case one fetched up in the water. I took it off. . . . . Fascinating sight, those two pillars of white flame. By Heaven! the center one had turned red, it wavered, it decreased in height, it grew again, but the spell was broken and I rushed to the ladder which led from the waist to the boat-deck in order to get up to the fire and assist. I ran a few steps and tripped up over a heap of bodies. I got up, tried not to tread on soft things, and arrived on the boat deck. The firing had ceased, the commander and h. b. were at the central fire. It suddenly went out, so did the foremost one. Everything was pitch black. Where were the Germans? Nothing but groans from dark corners. Though I did not know it at the time, the Germans had fled. They fled because A., our torpedo lieutenant, had fired a 21-inch torpedo. At 41 knots, the torpedo had shot across and striking the *Frauenlob* had blown her in half. Out of 300 Huns in her, seven survived. I have their account of the action before me. They say, 'the leading ship of the British line burst into flame and blew up. . . . . Then we were torpedoed.' They were wrong—their friends sheered off just a few seconds two soon."—*Army and Navy Gazette*, 5/3.

FEATURES OF THE "REPULSE."—The main armament of the *Repulse* consists of six 15-inch guns, of the mark first adopted for the *Queen Elizabeth* class, and described by Mr. Winston Churchill as the best gun we have ever produced. In view of Sir E. Tennyson d'Eyncourt's paper, and of the official data contained therein, it is now permissible to speak of this weapon rather more freely than was desirable while the war conitnued. The gun has great longitudinal strength, and has been quite free from the defects which revealed themselves in the case of the very long 12-inch model that ante-dated the 13.5-inch and 15-inch. The last-named has the relatively modest length of 42 calibers, and its shell weighs 1920 pounds. Thus, the total weight of metal fired at each discharge from the six guns of the *Repulse* is 11,520 pounds; as against the 11,200 pounds fired from the eight 13.5-inch guns of the *Tiger*. But the novel feature of the *Repulse's* armament is the system of mounting the 4-inch quick-firers, of which she carries 17. Fifteen of these guns are mounted on triple carriages, an arrangement permitting concentration of fire which is very useful against attacking torpedo craft. The triple mounts are quite simple in design. The three guns, of course, are trained as one, but in all the other motions each weapon is independent of the others, and is loaded and elevated as a unit. The crew of each triple 4-inch mounting numbers 21. Although the system had been subject to trial before being installed in the *Repulse* and several other ships, it is still more or less in the experimental stage, and has not yet found universal approval. The prevailing opinion seems to be that concentration of fire is purchased at too heavy a sacrifice of accuracy and rapid working.—*The Engineer*, 5/23.

PROGRESS IN AERONAUTICS.—The Aeronautical Commission of the Peace Conference is well advanced by now with the ground-work of the International Convention regarding aircraft, and with the framing of the regulations which are to be contained in annexes to the Convention concerning the marking of aircraft, certificates of air-worthiness, log-books, rules as to signals, rules of the air and regulations for air-traffic on aerodromes and on the vicinity of the latter.

With regard to the marking of aircraft a system of marking by capital letters has been recommended. The first letter will represent the national

mark of the country from which an aircraft hails. This will be followed by a group of four capital letters (pronounceable as a syllable, if possible), containing at least one vowel. A complete group of five letters is to be used as a call sign in making or receiving signals by wireless. In the case of aeroplanes, the marks are to be painted once on the lower surface of the lower main planes, and once on the upper surface of the top main planes, and also along each side of the fuselage. In the case of airships and balloons the marks are to be painted on both sides. The height of the marks must be equal to four-fifths of the width of the wing in the case of aeroplanes, and in the case of airships at least one-twelfth of the circumference at the maximum diameter, but they need not exceed 2½ meters in height. They are to be painted, or affixed, in black on a white ground.

The main conditions governing certificates of air-worthiness include approval of design, flying-trials of the first type, approval of workmanship and materials, and equipment with suitable instruments.

The recommendations as to log-books contemplate four different kinds—journey log, aircraft log, engine log, and signal log. The journey log is to be kept up by all aircraft in the case of international flights, the other three are only obligatory in the case of commercial aircraft and are to contain entries of a technical character, the engine and aircraft logs including a record of the life of the engine and aircraft.

The rules as to lights are modelled to a certain extent upon similar rules in use at sea, and there are detailed rules as to aircraft wishing to land at night, and in the case of aircraft in distress. These include the use of Very lights and certain visual or wireless signals.

The rules of the air follow the rules of the sea in many respects, especially in the case of the passing rule, when two aircraft are meeting. In that case each must alter its course to starboard.

Regulations for air-traffic on or in the vicinity of aerodromes contemplate the use of colored flags, indicating whether the circuit which an aircraft may find it necessary to make, when about to land, should be clockwise or anti-clockwise. There is also a very essential provision for dividing every aerodrome into three zones, when landing upwind. The right-hand zone is to be the taking-off zone, and the left-hand the landing zone, and between the two there is to be a neutral zone, into which, after its landing-run, an aeroplane will immediately taxi.

In the general provisions at the end of this code there is a rule, providing for every aircraft which maneuvers under its own power on the water, conforming to the regulations for preventing collisons at sea.—*United Service Magazine*, May.

The Admiralty announces that it has been decided to place a memorial tablet on board each merchant vessel that acted as decoy ship during the war, the tablet to be inscribed with certain details of service, together with the names of commander and members of the crew who received decorations.—*London Army and Navy Gazette*, 5/24.

VICKERS' VIMY-ROLLS AEROPLANE.—The overall length of the machine is 42 feet 8 inches, and the total height is 15 feet 3 inches. The span of the main planes, both of which are equal, is 67 feet, and the chord is 10 feet 6 inches. This gives a wing area, allowing for the part of the bottom plane cut away for the fuselage, of 1330 square feet. The engines give the machine a speed of 100 m. p. h. when fully loaded with bombs at a height of 10,000 feet, which height is reached in 50 minutes. Without bombs the same altitude is reached in 23 minutes, and the speed in this condition is 103 m. p. h. The machine is capable of flying for 11 hours at full speed at a height of 10,000 feet.

To the overall dimensions of the main planes already given we may add that the gap between them is 10 feet.

To equip the machine for the Atlantic flight it was, of course, necessary to provide greatly increased capacity for the storage of petrol. The bomb racks were therefore removed, and the space occupied by these, and also by the gunner's cockpit, was used for the accommodation of the extra tanks. The capacity of the petrol tanks has now been increased to 865 gallons, which, it is calculated, will give the machine a range of 2440 miles at a cruising speed of about 90 m. p. h. The maximum speed, however, is still over 100 m. p. h., and the machine is capable of flying at about 70 m. p. h., with one engine out of action.—*Engineering*, 5/9.

HANDLEY-PAGE BIPLANE.—The Handley-Page biplane has a wingspread of 127 feet, the chord of which is the distance between the upper and lower planes 15 feet 8 inches, and a plane surface of 3040 feet, with a lifting capacity of 9.08 pounds per square foot. She is fitted with four Rolls-Royce Eagle engines, giving a total rated horsepower of 1500 and actually developing well in excess of this rating.

Some idea of the power of the Handley-Page plane, originally built to bomb Berlin, can be gained from the following facts: When first built the machine weighed, unloaded, 14,000 pounds. The gasoline capacity was 1190 gallons, weighing 7140 pounds. The wireless apparatus was weighed at 200 pounds, and there was also provision for 6640 pounds of bombs, twelve machine guns weighing 757 pounds, and a crew of seven men weighing 1206 pounds, making a total load-carrying capacity of 29,943 pounds. Thus loaded the planes had a cruising speed of ninety miles an hour. By eliminating the bombs, machine guns and other paraphernalia, it has been possible to increase the fuel capacity to 2366 gallons as compared with the 865 gallons of the Vimy-Vickers, the 330 gallons carried by the Sopwith and the 370 of the Martinsyde. With this fuel load which can be carried on the journey over the ocean, the engines will consume an average of 108 gallons of gas per hour, giving an approximate cruising radius of twenty-two hours of continuous flight without making any wind allowance.—*N. Y. Times*, 5/25.

NEW BRITISH AIRSHIPS.—It is well known that at least four airships larger than the *R-33* and *R-34* are at present under construction in this country for the British Admiralty. These new vessels, it is understood, are being built by Messrs. Beardmore, Armstrong-Whitworth, and Short Brothers, and are reported to be designed to have a lifting capacity of 70 tons. They will have a length of 700 feet, contain 2½ million cubic feet of gas, and cost about a million pounds apiece. Their speed will be in the neighborhood, it is believed, of 80 miles an hour. Two of the vessels will be fitted, we learn authoritatively, with four 350-horsepower "Cossack" type Sunbeam-Coatalen engines; the other two will have four "Cossack" engines and, in addition, two 250-horsepower "Maori" type engines, giving a total of 1900 horsepower. These vessels, it is expected, will be completed round about the end of the year.—*The Engineer*, 5/16.

The British Daily Weather Report, issued by the Meteorological Office in London, has recently undergone a notable expansion, reflecting the great increase in the work carried on by England's "Clerk of the Weather" in response to the varied demands that arose during the war. Since April 1 the report has been issued in three separate sections; viz., a British Section, an International Section and an Upper Air Supplement. All three sections contain weather maps. In the Upper Air Supplement there are maps of the British Isles showing the winds at various levels from the surface up to 15,000 feet, for afternoon, evening and morning. This is primarily for the information of aeronauts, but will prove of great interest to all meteorologists.—*Scientific American*, 6/7.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, MAY 31, 1919

Type, number and name	Contractor	Per cent of completion				Contract date of completion
		June 1, 1919		May 1, 1919		
		Total	On ship	Total	On ship	
Battleships[1]						
43 Tennessee	New York Navy Yard	75.6	71.1	72.6	68.6	1/9/19
44 California	Mare Island Navy Yard	62.9	52.9	59.9	48.9	....
45 Colorado	New York S. B. Co	25.	3.8	20.4	3.4	5/17/20
46 Maryland	Newport News S. B. & D. D. Co.	48.	37.5	45.9	35.9	....
47 Washington	New York S. B. Co	23.2	3.2	18.5	2.8	11/17/20
48 West Virginia	Newport News S. B. & D. D. Co.	22.1	2.2	21.3	2.2	....
49 South Dakota	New York Navy Yard	0.	0.	0.	0.	....
50 Indiana	New York Navy Yard	0.	0.	0.	0.	....
51 Montana	Mare Island Navy Yard	0.	0.	0.	0.	....
52 North Carolina	Norfolk Navy Yard	0.	0.	0.	0.	....
Battle Cruisers						
1 Lexington	Fore River S. B. Co	....	....	....	....	....
2 Constellation	Newport News S. B. & D. D. Co.	....	....	....	....	....
3 Saratoga	New York S. B. Co	....	....	....	....	....
4 Ranger	Newport News S. B. & D. D. Co.	....	....	....	....	....
5 Constitution	Phila. Navy Yard	....	....	....	....	....
6	Phila. Navy Yard	....	....	....	....	....
Scout Cruisers						
4	Todd D. D. & Const. Co	27.3	4.7	26.2	2.9	8/1/21
5	Todd D. D. & Const. Co	25.6	3.4	24.3	2.5	12/1/21
6	Todd D. D. & Const. Co	21.2	1.	20.1	1.	7/1/22
7	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.	8/1/21
8	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.	11/1/21
9	Wm. Cramp & Sons Co	10.	....	10.	....	....
10	Wm. Cramp & Sons Co	10.	....	10.	....	....
11	Wm. Cramp & Sons Co	1.	....	0.	....	10/1/21
12	Wm. Cramp & Sons Co	1.	....	0.	....	1/1/22
13	Wm. Cramp & Sons Co	1.	....	0.	....	4/1/22
Miscellaneous[2]						
Fuel Ship No. 16, Brazos	Boston Navy Yard	95.	94.5	93.1	92.6	....
Fuel Ship No. 17, Neches	Boston Navy Yard	24.5	6.	23.8	1.5	....
Fuel Ship No. 18, Pecos	Boston Navy Yard	.2	.2	.2	.2	....
Gunboat No. 21 Asheville	Charleston Navy Yard	83.5	81.5	81.3	79.3	....
Gunboat No. 22	Charleston Navy Yard	3.	2.	1.3	.3	....
Hospital Ship No. 1	Phila. Navy Yard	31.	22.	27.4	15.8	....
Amn. Ship No. 1, Pyro	Puget Sound Navy Yard	90.	83.	86.	78.	....
Amn. Ship No. 2, Nitro	Puget Sound Navy Yard	46.	30.	38.	18.	....
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	....	....	....	....	....

[1] Battleships authorized but not under construction or contract (2) Nos. 53 and 54.

[2] Miscellaneous vessels authorized but not under construction or contract (4):
- 1 submarine tender No. 3.
- 2 destroyer tenders Nos. 3 and 4.
- 1 transport No. 2.

There are 12 destroyers and 10 submarines authorized but not under construction or contract.

There are 178 destroyers, 68 submarines, 11 mine sweepers, 19 sea-going tugs, 29 habor tugs, 12 oil tankers and 51 Ford eagles in various stages of completion.

NAVAL POLICY

SALE OF OBSOLETE BATTLESHIPS.—In addition to the four ancient battleships which were removed from the navy register some weeks ago—the *Indiana, Iowa, Massachusetts*, and *Oregon*—several more are destined to share the same or a similar fate in the very near future. The Navy Depart-

ment is now considering the disposition of eight battleships, all of which have been outclassed and are obsolete so far as their fighting value is concerned. These vessels are the *Kearsarge, Kentucky, Illinois, Alabama, Wisconsin, Maine, Missouri,* and *Ohio.* Some of these vessels are now engaged on duty with the midshipmen's practice cruise, and no steps will be taken towards placing them out of commission until the expiration of the summer cruise. Meanwhile the board of inspection and survery will investigate the subject and make its report as to whether any of the vessels could be retained on the navy register. These vessels were built in the period following the Spanish War. If they are placed out of commission, it is estimated that there will be released for more modern vessels approximately 10,000 enlisted men and about 400 officers.—*Army and Navy Register, 6/7.*

FILIPINOS TO MAN OWN GIFT SHIPS.—The Philippine Islands have the distinction of being the first American dependency to give to the federal government a destroyer and a submarine for the navy. In return the Navy Department has provided for the training of Filipinos as seamen, so that members of the crews, including petty officers, of the two ships will be natives of the Philippines. The destroyer *José Rizal* and the submarine *F-30,* now building at the Union Iron Works, San Francisco, are the two gifts of the Philippines. There are now in training at the Mare Island Navy Yard 97 Filipinos who will be members of the first crew of the destroyer. Others will be added until the full complements of 114 for the destroyer and 39 for the submarine are provided. Heretofore, with few exceptions, Filipinos have been enlisted in the navy only as mess attendants, but when the gift was announced an order was issued by the Navy Department to the commanding officer of every ship afloat to nominate from his crew such Filipinos as he considered capable to form the complements for the new vessels.—*Army and Navy Journal, 5/17.*

PERSONNEL

NAVY COMMISSIONED PERSONNEL.—Discussion continues in naval circles over the possibility that Congress may enact legislation for the early discharge of officers of the navy and marine corps from their temporary commissions, which would involve demotion to lower commissioned, warrant and enlisted grades of those belonging to the permanent personnel and the entire separation from the service of those drawn from the naval reserve force, national naval volunteers, and civil life. In these columns last week it was stated that it was not seen "how the service can get along with only the permanent allowances of officers, which is just sufficient for the permanent force of 137,000 men in the navy and 14,700 in the marine corps." It was not intended to indicate that those branches of the naval service were in possession at present of the full allowance of permanent officers for that number of enlisted personnel, for, as a matter of fact, the actual number of permanent officers is far short of that. In the navy the allowance of line officers is 4 per cent of the enlisted force, the permanent strength of which is 137,485 men. Thus there should be 5499 line officers, whereas there are actually in the service, including approximately 225 midshipmen to be appointed ensigns this month, only 2925 line officers, leaving a deficit of 574, which is made up by temporary appointees. With the permanent navy temporarily increased by executive order, in accordance with the law, by 50,000 men, or to 187,485, there should be 7499 line officers, but there are only about 6744 such officers, this number being made up of the 2925 permanent officers and 3819 temporary ones, and there is an actual deficit of 755 officers. Of the temporary officers, about 2088 came from the naval reserve force and the national naval volunteers, and about 1731 that hold temporary commissions, lieutenants, junior lieutenants and ensigns from their permanent warrant and enlisted grades in the regular navy. While the demotion of officers to lower commissioned grades will be sufficiently demoralizing,

the consequences to the almost 2000 officers, most of whom have proved their qualifications as commissioned officers, that will have to go back to warrant and enlisted ratings will be far more discouraging and unjust, and it is hoped in the service that, if Congress does not do anything for the permanent commissioned officers, it will enact legislation that will permit the other class of temporary officers to obtain permanent commissions under proper restrictions. While officers have no hope of having the pay-tables revised upwardly this year, nevertheless they feel that it should be done. Such a revision undoubtedly would be made to include pay of army officers, and, with the army at its present size, Congress would consider the cost prohibitive. Accordingly it is likely that nothing will be done toward readjusting service pay until the services get back to the strength ultimately to be fixed by Congress as permanent. Secretary Daniels has refused to approve increase of pay on the ground that a large proportion of the commissioned personnel is receiving higher pay by reason of promotion. Of course, this argument is fallacious and does not apply if officers are forthwith to be demoted, some of them by two or three grades.—*Army and Navy Register*, 6/7.

ADMIRAL SIMS OPENS WAR COLLEGE.—*Thirty Officers in New Class.*—The Naval War College was reopened informally on June 2, the occasion being marked by an address on the basic principles of the course of instruction at the college by Rear Admiral William S. Sims, U. S. N., president of the college, who resumed his duties that were interrupted by the war, as were the classes. Addressing the 30 officers comprising the new class, Admiral Sims said in part:

"There has been wasted during this war a great deal of effort, much valuable material, and even many valuable lives because of the lack of training necessary to reach logical decisions based upon the well-known immutable principles of war. The constant prayer of those who bear great responsibility in time of war is that they may be spared the results of the decisions of the so-called practical officers who are ignorant of the art of war and who have not been trained to think straight—that is, who have not been trained to make a logical estimate of a situation.

"It should be clearly understood that the college does not propose to establish a code by which naval warfare can be conducted. It does not propose rules for meeting various situations. This would be wholly impossible because of the infinite variety in the character of the conditions and situations. Each problem must be dealt with on its merits, in accordance with certain general principles which it is the object of the college to develop and to teach. That is, the college aims to supply principles, not rules, and, by training, develop the habit of applying these principles logically, correctly and rapidly to each situation that may arise. The college does not claim to show what should be done in particular cases, but hopes that the college training in the appplication of the principles of warfare to problems based upon modern conditions will enable you to reach acceptable solutions in any case that may arise.

"As there sometimes arises the impression that the college is, or should be, the plan-making branch of the navy, it may be well to repeat the explanation of its proper function that has been given by former presidents. It is true that the college could supply plans as required if it were provided with a special staff for this purpose many times larger than its present staff, but as the data essential for this work are necessarily continuously accumulating in the various branches of the Navy Department, it is manifest that such a planning section should not be located here."

Limitations of the College.—"It would be wholly impossible for the teaching staff to undertake plan-making in addition to its own work. It is for this reason that the college does not assume, and cannot undertake, any administrative functions. Administration involves action, and the essential function of the college is not action but training for action. While we

cannot supply strategic plans required by the Navy Department we hope to supply officers who can formulate such plans. Similarly, we cannot supply tactical battle plans to fit all conditions that may arise in the fleet; but if the college course proves successful it will supply commanders-in-chief and fleet staff officers competent to prepare and carry out such plans. If the college should be required to do planning work it would cease to be a teaching institution and become a part of the general staff, with the duty of supplying plans instead of officers trained to prepare plans.

"Some officers have admirable knowledge and experience, but fail in the quality of military character. They are honest, loyal, zealous and devoted. They know the principles of warfare, but do not always exercise the will and self-control to apply them. They understand the principle that in extensive organizations work should be divided according to specialties and the head of each section given full responsibility and authority, but they do not apply it—hesitating to allow authority, even in minor matters, to pass out of their hands. This subject will be taken up in due course. Its importance is due to the fact, often demonstrated, and particularly so in the Great War, that not infrequently officers of quite exceptional ability, knowledge, experience and energy failed to succeed because they did not understand, or did not apply, the principles of military character."

Admiral Sims also made some references to the importance of the submarine in warfare, pointing out particularly the value of the larger underwater craft, those with a cruising radius of two or three months. For scouting purposes he considéers such a craft a dangerous weapon against other types of scout vessels. He said destruction of enemy submarines in the war was most effective by Allied submarines, England especially being successful in this way.—*Army and Navy Journal*, 6/7.

NAVY POST-GRADUATE SCHOOL AT ANNAPOLIS OPENS.—Exercises were held at the U. S. Naval Academy at Annapolis, Md., on the night of June 12, marking the reopening of the Post-Graduate School of the Navy. The school is attended by twenty ordnance engineering officers and thirty officers from the Bureau of Steam Engineering. The exercises were attended by Secretary of the Navy Daniels and party, and by a large number of officers attached to the Naval Academy. In his address to the school the Secretary emphasized that the students were assigned to the school for special training as experts because there must be a few officers who will be especially designated as expert engineers throughout the entire length of their service. He added: "Due to various reasons sufficient importance is not given by the officers of the navy, as a whole, to the value of engineering duties. I think it would be well if all young officers, immediately upon completion of their course at the Naval Academy, were required to perform engineering duties in a ship for a certain continuous and definite time. It is my opinion that their experience would serve as the best foundation for all the duties which young officers would be called upon to perform in their future service. . . . It is a false theory that some men shall give themselves to problems of battle practice, others to engineering and to ordnance. The great commander is greater if he has been trained in all, for knowledge of engineer and ordnance duties is essential to the highest when in command of modern machine warfare."—*Army and Navy Journal*, 6/14.

MERCHANT MARINE

WILL BIND THE TWO AMERICAS.—Plans for the establishment of direct steamship lines connecting American Atlantic, Gulf and Pacific ports with South and Central America were laid before the Pan-American Commercial Conference here to-day by Chairman Hurley, of the Shipping Board. They call for direct lines from New York to Brazil, Argentina and Chili; from New Orleans, or Mobile to the west coast of South America, and Seattle and other Pacific ports to Western South American ports.

The line between New York and Brazil and Argentina, Mr. Hurley said, will be inaugurated on November 1, with the former German liners *Mount Vernon, Von Steuben* and *Agamemnon,* which are to be remodeled for this trade. These vessels have a speed of 23½ knots an hour and will be able to make the trip from New York to Rio de Janeiro in nine days and to Buenos Aires in fourteen days.

"Contemplated plans," said Mr. Hurley, "call for at least two lines from New York to serve the West Indian trades, one of them covering the Eastern Caribbean and the other the Western Caribbean, with canal connections at Colon. To serve the swelling commerce of the west coast a line will be maintained connecting Valparaiso and the other western ports with Mobile or New Orleans. We have to-day a passenger service from New York to Valparaiso, which is nine days shorter than existed one year ago. As soon as the army returns our American transports we will have weekly service from New York to Valparaiso on five passenger lines through the Panama Canal.

"Good liner service between Valparaiso and Seattle, with calls at all the important Pacific ports, and also between San Francisco and New York will be assured, and American lines already established in this field will be supplemented where required. Finally and most important, there will be a line from New York to the ports of Brazil and the River Plata. Modern ships of the passenger cargo type operated over these lines will connect the great centers of trade, and to them will flow commerce from many intermediate points.

"It is realized that nothing less than the best will serve to satisfy the demands of Latin-American travelers and exporters. Therefore, no effort will be spared to make these lines conform to the highest standards of modern steamship service. It is hoped to have them specially designed for the South American trade and equipped with the conveniences and luxuries which the long trips in tropical seas require. The 14 ships under consideration for these trades are of about 18,000 gross tons, with accommodations for about 300 first-class passengers.

"Before the war the best ships in direct service from the United States to the eastern ports of South America made only 15 knots, offered only fortnightly sailings and took 24 days for the trip from New York to Buenos Aires. Compare this with the service to be expected in the immediate future. Three magnificent ex-German liners, the *Mount Vernon,* the *Von Steuben* and the *Agamemnon* are to be remodeled for South American trade. These ships make 23½ knots, so that the trip from New York to Rio de Janeiro can be made in nine days and that to Argentina capital can be made in 14 days. There will thus be a saving of at least a month's time on the round trip."

Mr. Hurley told the conference that 226 ships of 863,334 dead-weight tons already had been allotted to the Latin-American trade and that others would be assigned as soon as they became available.

Enthusiastic applause greeted Mr. Hurley's announcement of improved steamship service to South America. He pointed out that the mail service between the two countries would be greatly improved. Mail between the United States and South America is now being carried in foreign vessels, but it will be transferred soon to American ships, Mr. Hurley said, and by the improved service a letter mailed in New York will reach its destination in Buenos Aires in 15 days. Within one month a reply may be received in New York.—*New York Times,* 6/5.

204 VESSELS DELIVERED THIS YEAR TO SHIPPING BOARD.—From January 1 of this year to May 7 a total of 204 steamships, with an aggregate of 781,980 gross tons were delivered to the United States Shipping Board by American yards. From January 1, 1918, to December 31, 1918, the output was 527 steamships, with an aggregate gross tonnage of 1,991,587.

April of this year was the banner month in deliveries, the total being 93 steamships of 320,280 gross tons. The previous best month was October, 1918, when 263,000 gross tons were delivered.

Deliveries for 1919 were as follows:

Type	Number	Tonnage (gross)
Steel	161	683,780
Wood	39	88,867
Composite	4	9,333

—*U. S. Bulletin*, 5/19.

DEMOUNTABLE SHIPS PROPOSED.—Seattle steamship operators and district lumber producers are watching with interest developments on the new demountable ship recently patented by a Victoria shipper, says the Seattle *Post-Intelligencer*. There is hope that the proposal will materialize, as its success will relieve those who are concerned over the scarcity of bottoms for lumber cargoes. The new plan contemplates constructing boat and cargo together and selling the entire outfit on arrival at its destination.

It is reported in shipping circles that the Furber Lumber Company of Mexico is interested in the venture and will construct a number of these vessels at an early date, with engines capable of a 7-knot speed. The engines will be sent back to the point of origin for another ship after the voyage is made. It is claimed that the new device can be constructed as cheaply as putting the lumber inside of any ordinary ship. The method of fastening the ships together will be such that after its voyage the nuts and bolts are taken off, leaving all the lumber ready for distribution.

A boat which now carries only 1,500,000 feet of fir would, under the new patent, carry 5,000,000 feet, and no provision would have to be made for the return cargo, it is claimed.

Naval Engineer J. H. Price has assumed charge of constructing the new demountable ship for a Canadian and Washington lumber company.—*Nautical Gazette*, 6/14.

NAVIGATION AND RADIO

RADIO COMMUNICATION IN ALASKA.—The army signal corps plans to use wireless in communicating with Alaska when the present cable is worn out. The cable will not last much longer, and an appropriation of $250,000 is desired to cover the establishment of six additional modern wireless stations to complete a chain of stations from Seattle to Fairbanks. There are 13 stations now in operation in Alaska for interior communication, and the returns from commercial business show they are self-supporting. The government use of the service was not counted in the financial returns, although it was 75 per cent of the total business.—*Army and Navy Register*, 6/7.

ENGINEERING

NEW DESTROYER DOES 38.38 KNOTS.—All speed records of the Rockland trial course have been broken by the new torpedo-boat destroyer *Hale*, according to an announcement by officials of the Bath Iron Works to-day. A mean speed of 37.63 knots was made during builders' preliminary trials, while the fastest mile, with wind and tide favoring the ship, was made at the rate of 38.38 knots an hour.—*N. Y. Times*, 6/8.

X-RAY EXAMINATIONS APPLIED TO THE METALLURGY OF STEEL.—The following is an abstract of a paper presented at the joint meeting of the Faraday Society and the Röntgen Society, recently held in London, by Sir Robert Hadfield, Bart., Mr. S. A. Main, B. Sc., and Mr. J. Brooksbank:

(1) The possibilities of X-ray examination in steel manufacture will be readily apparent. The means which it provides for enabling the metallurgist

to see the interior of steel castings and forgings, and thus to diagnose and localize the diseases to which steel is subject, must prove of considerable benefit.

(2) The chief difficulty hitherto has been the limited thickness of metal which could be penetrated, but considerable strides have been made within the last year or two in this direction. Thicknesses up to 4 inches are now said to have been successfully radiographed.

(3) It is obvious that to be of service it must be possible to examine articles of a practical size; otherwise the chief advantage of such a method of examination is lost—namely, its non-destructive character. A few years ago, and even now with the larger articles, it was necessary in order to examine a casting to cut out a section to obtain a radiograph, thus destroying the article for practical purposes. While this served its purpose for research examination, it still left the wider application—that is, for inspection of articles intended for service—untouched. The advantages of applying the method to the routine examination of special steel castings and forgings in the course of their manufacture, to ensure their being thoroughly sound, will be at once apparent.

(4) X-ray examination need not necessarily be confined to the steel products themselves, but also to materials used by the steel manufacturer; another application which suggests itself is the examination of welds.

(5) The question of internal defects has always been a bugbear. In the case of an habitual tendency, such as the well-known "pipe" in ingots, this usually reproduces itself under similar conditions of manufacture, and can be controlled by the cutting up and examination of an individual ingot out of a lot, this forming a criterion of the whole. Many of the defects met with are, however, of a casual nature, and the use of X-rays will help in these cases by individual examination and elimination of the defective articles.

(6) Apart from the mere detection of defects, it is a distinct advantage to have these defects visualized to the eye, and the perspective view presented by a stereoscopic radiograph carries much more information to the mind as to the nature of the defect than the alternative method of fracturing the article through the defect, which only presents a sectional view.

(7) The routine operation of X-ray examination will be much facilitated if the necessity for photographing can be avoided; that is, if articles may be examined by the use of a fluorescent screen. This would very much increase the rate of examination and, after all, in inspection work, the majority of the articles are expected to be free from defects and, therefore, no permanent record is required. In those cases where a permanent record is required, the particular articles may, of course, be put on one side for the purpose.

(8) A further point is that of expense. Present apparatus for the purpose is costly and delicate, and its operation of a rather expert nature to be applied to routine purposes.

(9) It must be borne in mind that in the present state of the science, X-ray examination does not magnify defects, so that its utility is limited to those defects which are of a size within the visibility of the naked eye. Many of the defects in steel arise from microscopic causes, and these must still rely for their elucidation on the valuable work covered by micrography.

(10) Quite apart from the question of defects in steel is the very valuable field in theoretical metallurgy, opened up by Professor W. H. Bragg and followed with great ability by Professor A. W. Hull, applied to the atomic and crystalline structure of metals. Whilst this subject is rather a matter for the research laboratory, it should eventually give positive evidence on vexed questions, concerned with the atomic structure, such, for example, as allotrophy, on which, hitherto, it has only been possible to theorize.

(11) A still further application for X-rays in metallurgy, which may perhaps be mentioned, is the analysis of steels. Chemical methods are so

well established and on the whole so satisfactory, that X-ray examination can hardly take their place. Still, the subject is one which may well be worked upon both for its own sake and the additional viewpoint which it provides as to the constitution of steels.—*Page's Engineering Weekly*, 5/10.

VALVES AND FITTINGS IN MARINE WORK.*—It has taken this world war to accelerate the adaptation to ships of much of the standard central-station apparatus. Certain factors are now at work which have considerable influence on present marine practice in valves and piping. Of these the greatest is the fabricated-shipyard. In the old-style yard, the shops would make up any or all of their fittings or valves to their special designs, each yard having its own designs which differed from those of other yards. The result of this was a constantly increasing number of special valves and types in each shipyard, with the consequent increase in cost of ship construction.

The fabricated-shipyard, however, has been forced to buy in the open market and in order to get deliveries has had to purchase standard types and sizes. This has caused engineers to study their valves and endeavor to standardize them. In one yard it was thus found possible to reduce the number of types by 20 per cent.

It is entirely practicable to use manufacturers' standard stock patterns for nearly all valves, fittings and auxiliary equipment, and this standardization, with consequent reduced costs, will be one of the deciding factors in maintaining our shipbuilding supremacy after the war. Standard valves require fewer repair parts and these are more easily procurable for renewal. Decided advantages may be gained by still further extending present standardization.

Piping.—A factor which has influenced piping practice is the availability of materials. For instance, copper piping in sizes suitable for steam mains has become so scarce that open-hearth lap-welded steel pipe is often adopted in its place. The use of copper piping has long been standard practice on shipboard. This piping has considerable flexibility and generally stands up well in marine service, but it is not well adapted to superheat conditions. Steel pipe is much cheaper than copper pipe, is more readily available, and is well adapted to any pressures and temperatures that may be encountered.

Some engineers fear that it may lack the flexibility of copper pipe, although steel piping in central stations is frequently subjected to strains from contraction and expansion as severe as one finds on board ship; furthermore it is frequently subjected to severe stresses due to unbalanced turbine rotors and other harmonic vibrations. The substitution of steel for copper piping is merely a matter of marine engineers becoming accustomed to designing and installing their steam systems in accordance with steel-pipe standards. In other words, it is dependent on their ability to break away from traditional practice.

Steel pipe, however, does not withstand corrosion as well as copper pipe. Galvanized steel pipe has been tried for this purpose. In time the galvanized material flakes off under the influence of heat and causes trouble. Repeated painting of such steel pipe seems to be the best protection.

Galvanized pipe should be used on sanitary systems and bilge and ballast piping. However, no advantage is gained by galvanizing the cast-iron fittings of these systems. It is also questionable whether fuel-oil piping in oil-burning ships needs to be galvanized at all.

The problem of caring for expansion has made many engineers prefer copper to steel in piping. In general, long-radius bends provide the best means for taking care of expansion difficulties. Space is limited in vessels,

---

* Presented at meeting of Baltimore Section, American Society of Mechanical Engineers.

but much may be accomplished in the way of providing such bends if a little study is given to the subject. Some have questioned the flexibility of bends of extra heavy steel pipe. The Crane Company tables indicate that there is usually ample flexibility to care for any lengths that are generally used on shipboard.

Pipe Flanges.—Expanded flanges of the Lovekin or similar types are almost universal with copper pipe. Lovekin flanges are used to some extent with steel pipe, but welded or screwed joints are more common. Land practice in piping seems to have advanced far beyond marine practice in the use of the Van Stone joint. It is said that the first installation of this type of flange on shipboard many years ago was not a success. Apparently this has condemned an excellent joint ever since. Although giving excellent service under most exacting conditions on land, it is taboo at sea. The welded type of Van Stone joint now in use in central stations has apparently never been tried out at sea.

Fittings.—With superheated steam, and in general with all steam of over 150-pound pressure, it is advisable to use cast-steel fittings on the steam lines. For pressures of 100 to 160 pounds, extra heavy cast-iron or better still, semi-steel fittings may be used. For pressures below 100 pounds, cast-iron or malleable fittings of standard pattern may be used. In screwed fittings the collar over the threaded portion should be sufficiently heavy to prevent distortion when screwing up with pipe wrenches. Malleable iron is preferred by many on account of its lesser liability to rupture under stress. However, such fittings are generally lighter than cast-iron and are sometimes deformed in screwing up.

In central stations it is very common practice to find branch outlets welded to the main pipe and in general these welded pipes have given very excellent service. This practice is apparently very little used in marine work, although it would make a weight-saving construction by doing away with many cast-iron special fittings now used.

Valves.—Standard types of valves must be bought if one is to place orders in the open market under present conditions. Steel valves are used for superheat. Some shipbuilders even specify steel valves for all boiler pressures of 200 pounds or greater. If superheat is not used the valves may be extra heavy, of cast iron or semi-steel. These materials are also used for auxiliary steam lines. Bronze valves are sometimes employed in the smaller sizes, but these are very much more expensive than the extra heavy cast-iron valves and in sizes of 2½ inches and over have no advantage over them except in lightness of weight.

Valves 2½ inches and above must have bolted bonnets to comply with the U. S. Steamboat Inspection Rules. The marine or cross-head type of yoke is much superior to the standard cast yoke for ship purposes. It weighs less and is generally stronger and more readily repaired. It costs very little more than the cast yoke, but is not "standard" with many buildings.

It is customary on board ship to use the screwed-union bonnet on 2-inch and smaller valves. This type of valve is generally more expensive than the ordinary bonnet type, but has many points of superiority such as its regrinding facilities, longer life and less liability to damage when dismantling. Valve manufacturers generally make the screwed-union bonnet valves in two weights, one to withstand 200-pound pressure, the other for 350-pound pressure. It is therefore necessary to use the 200-pound valves for many low-pressure services. This has considerable advantages, for fewer types of valves need be bought and their interchangeability is increased.

Cast-iron or semi-steel valves for marine service are usually required to have a solid bronze disk with bronze seat. The stem may be of rolled phosphor bronze, rolled naval brass or manganese bronze. Gland studs and nuts should also be of bronze. Steel valves for superheat generally have monel-metal disks and seats with bronze or nickel-plated steel stems. The

bronze generally used for valve bodies, disks, seats, glands, etc., is the navy composition "M" consisting of copper 87 per cent, zinc 7 per cent, tin 6 per cent, and may contain lead up to 2 per cent in place of part of the copper. The lead content must be kept as low as possible on account of the action of the salt water.

It is the practice of many marine designers to specify a flange corresponding to extra heavy standard on the sea side of all sea valves, sometimes even when these are connected to the sea chests. Usually the valve is in all other respects of standard weight. This extra heavy flange adds nothing to the strength of the valve, for its weakest point is in the neck behind this flange, which is sometimes but not always made extra heavy. Some maintain that the extra heavy flange is needed to stiffen the ship plate. This same result is secured elsewhere by adding a reinforcing ring to the ship's plates. This type of valve is a "special" to the manufacturers and hence is high-priced and often difficult to obtain on reasonable deliveries.

Shipbuilders generally have endeavored to use A. S. M. E. standards for flanges and drilling. However, some criticisms have been heard. For instance, many marine engineers do not favor the raised faces on extra heavy flanges. They prefer flat faces. The flat faces are also favored for bolting to bulkheads and to other ship plates.

The bolting specified for certain sizes in the A. S. M. E. standards has not been satisfactory to many designers. For instance, in the 3-inch and 3½-inch standard-weight flanges the A. S. M. E. standard calls for four holes, while many marine designers use six holes. Also, in the 2-inch and 2½-inch extra heavy flanges the marine engineers frequently use six holes where the A. S. M. E. standards specify four. The A. S. M. E. standards increase the holes at one jump from four to eight. There seems considerable justification of the use of the 6-hole flange.

One cannot help commenting on the small use made of gate valves on ships. These are especially adapted to fuel-oil service and could be used to advantage on many water lines just as in land practice. A greater use of gate valves would relieve the existing valve shortage to an appreciable extent and also reduce friction. Reducing valves, relief valves, separators, traps, injectors, etc., can all be supplied equally well from the manufacturer's standard stock patterns made for central-station work as from special marine designs.

It is rather difficult to understand the basis for marine practice in heating systems. Live steam is usually passed through a reducing valve and supplied to the heating system at 20- to 30-pound pressure. The advantages of exhaust steam for heating and of steam bled from the main turbine do not seem to be fully appreciated in marine practice. Such uses of steam would make operation less simple, but would result in a thermodynamic gain, especially in passenger ships and troop transports.

Inspectors are frequently required to apply tests to valves. In general, such tests are specified in Lloyds and U. S. Steamboat Inspection Rules. A satisfactory standard for inspectors is to test all high-pressure steam valves under hydraulic pressure to three times their working pressure and to test all other valves to twice the working pressure corresponding to their weight or classification.—*Shipping*, 4/12.

COLLOIDAL FUEL.—The imperative need for increased supplies of liquid fuel, particularly for naval purposes, has prompted American engineers to investigate the problem of incorporating solid and liquid fuels in such manner that the resultant mixture can be handled and utilized as ordinary oil fuel. The work was carried out under the auspices of the Submarine Defence Association with the assistance of the United States Navy Department, and the results are of importance as they promise not only conservation of oil fuel, but also utilization of low-grade solid fuel.

The use of pulverized coal alone necessitates the adoption of special burning installations, and the difficulties connected with handling and storage render it impracticable as a naval fuel. Attempts made hitherto to blend any appreciable proportion of pulverized solid with liquid fuel have failed because of the sedimentation of the solid. The problem has, however, now been solved by the special incorporation of a "fixateur" whereby a liquid of colloidal nature is obtained. By this means 30-40 per cent of coal (95 per cent of which passes a 200-mesh screen) can be suspended in oil for several months without material sedimentation. The composition of the fixateur, which is used to the extent of 7 per cent, is not disclosed. Other substances (not specified) are incorporated, the properties of which have some particular influence upon the combustion and characteristics of the fuel, *e. g.*, dispersion of solid particles, miscibility, viscosity, flash point, melting point, ash and sulphur content, drying and inoculation. Some of these substances may remain in the final product, or, having fulfilled their function, may be distilled off for further use.

One grade of colloidal fuel was devised to utilize some poor quality "anthracite rice" containing 25.5 per cent of ash and having a calorific value of 10,900 B. Th. U. per lb.: 38½ per cent of this was incorporated with 61½ per cent of Pressure Still Oil, wax tailings, petroleum pitch, and fixateur running 18,505 B. Th. U. per lb. The product contained 10.2 per cent. of ash and had a calorific value of 162,500 B. Th. U. per gallon. The calorific value of the fixated oil itself was only 151,750 B. Th. U. per gallon. This increased heating value has an important bearing upon transport costs and upon the steaming radius of ships. Further research was directed towards the blending of petroleum oils and coal tars with coke and asphaltic substances. A stable liquid fuel was made up of oil 45 per cent, tar 20 per cent, and pulverized coal 35 per cent, thereby replacing over one-half of the oil. Asphaltic and free carbon particles in Pressure Still Oil may also be stabilized, thereby rendering a low sulphur oil available for metallurgical uses. (*Colloidal Fuel: Composites of Oil, Tar and Carbon,* issued by the Submarine Defence Association, New York.)—*Technical Supplement, 5/27.*

THE STILL ENGINE.*—There are two methods of producing power by the combustion of fuel—either under boilers or within the main cylinders of combustion engines. The greater part of the world's power is still derived from steam, which, owing to its proved reliability and greater adaptability to the services demanded of it, holds the field in competition with its rival, the internal combustion engine, but the latter shows a far higher heat efficiency. Yet it cannot start itself; cannot develop its full power, except at full speed; is a poor performer at low speeds; can only operate on moderate overloads for short periods; and may cease to operate, owing to a small defect, without warning. So combustion engines have as yet made little progress in competition with steam in locomotive work, and have supplanted steam but to a limited extent in marine and stationary engines.

The maximum ideal efficiency of a heat engine is obtained where the difference existing between the highest and lowest temperatures of the working fluid is greatest in proportion to the maximum temperature, and here the internal combustion engine, with an initial temperature higher than the furnace temperature of the boiler, and even higher than the melting-point of cast iron, is capable of realizing better thermal conditions than any other form of heat engine; but in its turn it suffers from two disadvantages—it ejects its working fluid at a temperature too high for ideal conditions, and it loses heat energy to a regrettable extent in the cooling of its cylinder.

* From a paper by Mr. Frank D. Acland, Royal Society of Arts, May 26, 1919.

The possibility of combining in one engine the superior thermal cycle at the high temperatures and pressures of the combustion engine with the low thermal cycle of steam to deal with its rejected heat, and, in the same engine, to add the superior working advantages of the steam engine, is the basis of work carried out by Mr. W. J. Still.

The Still engine is an engine capable of using in its main working cylinder any form of liquid or gaseous fuel hitherto employed; it makes use of the recoverable heat which passes through the surfaces of the combustion cylinder, as well as into the exhaust gases, for the evaporation of steam, which steam is expanded in the combustion cylinder itself on one side of the main piston, the combustion stroke acting on the other side. It increases the power of the engine, and reduces the consumption of the fuel per horsepower developed.

Its primary object is not to use the waste heat for raising steam, but first to use it in improving the thermal conditions of the working cylinder, and so ensure the maximum efficiency from the fuel burnt within it, diminishing, as a consequence, the heat lost in that operation. Since the maximum efficiency is obtained by combustion of the fuel in the cylinder, and the minimum by the evaporation of the water in the steam generator, it is evident that the larger the quantity of steam which can be generated per horsepower developed by the combustion cycle, the lower must be the heat efficiency of the whole machine.

In the Still engine—see diagram—the jacket and cooling water form part of the circulating system of a steam generator, which may be an integral part of the engine, or external to it. The cooling water therefore enters and leaves the jacket at a constant temperature, regulated by the pressure of the steam, the cooling being effected by converting the water into steam without raising its temperature. Excluding the radiation losses, which are kept low by lagging, all the heat which passes through the walls is thus usefully recovered in the water as steam. The temperature of the cylinder wall is uniform over the whole of its exterior surface, and the heat lost to the cooling water at each stage of the cycle—compression, combustion, and expansion—is diminished.

During compression, owing to the walls being at steam temperature, the incoming charge picks up heat instead of losing it during the greater part of the stroke, an advantage of the greatest value to the heavy oil types of Still engines, where an air charge is taken in at the full outstroke, and is compressed to a pressure where its increased temperature ensures the certain ignition and combustion of the fuel which is injected into it.

During combustion and expansion the uniform and higher mean temperature of the walls reduces the heat lost to the jacket water. Some of the heat thus economized adds to the useful work on the piston, the balance passing out in the exhaust gases for recovery.

To ensure the maintenance in a practical and reliable manner of the temperature conditions which produce this efficiency during the combustion cycle, a departure from the design and construction of the cylinders of normal internal combustion engines is imperative. The cylinder of a Still engine consists of an inner liner, which is approximately one-third to one-fourth of the usual thickness; it is ribbed externally so as to add to its conducting surface and provide suitable passage for the cooling water, and it is reinforced by an outer hoop capable of withstanding the highest pressures to be met with in working. No failure of a cylinder of any kind has occurred, even under most severe, even abnormal test conditions, *e. g.*, with mean combustion pressures of 180 pounds per square inch in a two-stroke engine, to which was added overload steam mean pressures of 70 pounds, *i. e.*, a total mean effective pressure per revolution of 250 pounds per square inch.

The Still engine may be of the constant volume or constant pressure type, or a combination of both; its losses to the cooling water are not the

same as in a normal engine of either type, except in so far that they vary with the type, with the cycle, with the efficiency of the combustion stroke, and with the load. At normal and full loads, such heat units, in a Still engine, as pass into the jacket water, which is at steam temperature and pressure, are lessened and are wholly recovered without loss—radiation excluded—in overcoming the latent heat of the water and give off their steam in the steam space in proportion to the heat flow at those loads. At lower loads less steam is produced, until at still lower loads no steam at all is measurable. In other words, the jacket losses are practically eliminated.

The exhaust gases take a subsidiary, but important, part in the cycle; their usefulness in ordinary combustion engines, in raising steam, is limited to the amount of heat recoverable between the initial temperature of the exhaust and that of, say, 50 deg. Fah. above the steam temperature, after which the whole volume passes away to atmosphere at a still useful temperature, less a small percentage available for feed-water heating. But in the Still engine the exhaust gases, after raising their quantum of steam, are employed in preheating all the water required for the steam generated in the jacket water and in the generator. Trials at full efficiency over long periods and steady loads show terminal stack temperatures as low as 150 deg. Fah. The heat efficiency of the combined cycles is therefore exceedingly good, with an initial temperature of over 2000 deg. Fah. and a final exhaust to atmosphere at 150 deg. Fah.

The quantity of steam capable of being generated from "waste heat" depends upon the efficiency of the combustion cycle, and on the load. Some years of experimental work prove that the weight of steam recovered may vary from a maximum of about 7 pounds per brake horsepower hour developed by the combustion cycle of a four-stroke constant volume engine at full load to a minimum at light loads which is hardly measurable, and which only balances the loss due to radiation.

The engine used for this research was of constant volume type, four-stroke. It first underwent a series of tests, so as to arrive at its "initial horsepower" as an explosion engine, *i. e.*, without any power added by the steam cycle, and was carefully checked in this connection by comparison with well-known and authenticated trials carried out by the late Professor Bertram Hopkinson, F. R. S., and others. Though it was a single-cylinder unit with automatic inlet valves, its "initial horsepower" was rated on a par with the power given by four-cylinder sets with mechanically operated valves deduced from tests over very short periods under their best conditions.

The quantity of steam generated per "initial brake horsepower" from the jacket alone averaged 3.28 pounds per brake horsepower hour, and from the jacket and exhaust together 6 pounds per brake horsepower hour, this being the average of the whole of the trials over periods varying from 20 minutes to over 6 hours. The final 6 hours of a 7½ hours' continued test gave a total recovery of 6.9 pounds of steam per initial brake horsepower. A whole series of these early trials was carried out under the supervision of C. Vernon Boys, F. R. S., whose sympathetic interest and encouragement is gratefully acknowledged as having largely contributed to the progress made since the inception of the system.

Normal load.—The average mean effective pressure from the combustion stroke was 90 pounds per square inch. The steam evaporated by the "waste heat" gave 14 pounds per square inch mean effective pressure on every return stroke. This is equivalent to $90 + 28 = 118$ pounds per square inch mean effective pressure in a normal four-stroke engine.

Overload.—By admitting additional steam generated by fuel under the boiler, the steam mean effective pressure was raised to 72 pounds per square inch; the total mean effective pressure was therefore equal to $90 + 144 = 234$ pounds per square inch mean effective pressure in a normal four-stroke engine.

Gas Engines.—The first experimental engine constructed was a two-stroke engine capable of developing 590 brake horsepower from three cylinders at 400 revolutions, bore 8-inch. It was a high speed engine, designed with special regard to obtaining data about the recovery of steam from waste heat (jacket and exhaust). It was first operated on town gas—540 B. Th. U.'s, and subsequently converted for oil fuel. Its efficiency was not high, owing to its being a two-stroke engine with a short stroke, but its consumption per brake horsepower was 15 cubic feet per hour (31.3 per cent efficiency), a very promising result.

The outbreak of war prevented much progress being made in the design and construction of gas engines; but the results achieved give great promise of future development, for with a combustion indicated efficiency of 36 per cent, radiation 4 per cent, boiler loss 10 per cent, there remains 50 per cent for recovery; allowing 10 per cent efficiency for the steam cycle, a gain of 5 per cent is assured, and the total indicated efficiency of the engine will not be less than 41 per cent. If 20 per cent efficiency is obtained from the steam cycle, as appears possible, the total indicated efficiency will be 46 per cent.

A gas engine which can give a brake thermal efficiency 30 per cent better than its predecessors, and which, by governor control alone can meet any demand up to and over 100 per cent overload, while maintaining a good efficiency at that increased output, cannot be neglected.

Petrol and Oil Engines.—Four-stroke engines for petrol and similar fuels have been built and tested ashore and afloat.

A three-cylinder set (marine type) capable of developing on its three small cylinders at 600 revolutions per minute twelve 5-shaft horsepower at 90 pounds combustion mean effective pressure, without power from the steam stroke, gave on continuous running 16½ shaft horsepower under "waste heat" conditions, maintaining from the "waste heat" a steady boiler pressure of 100 pounds, with sufficient reserve for maneuvering in narrow waters or bringing up. It would pick up very rapidly when ignition recommenced, and bring up the boiler pressure to normal in a few minutes.

With the addition of a burner below the boiler it would run continuously and develop 38 shaft horsepower at 750 revolutions. Momentary overload in proportion to the capacity of the boiler reached 60 indicated horsepower (51.5 shaft). Under steam alone the engine is a most satisfactory performer, but not economical.

The Still oil engine starts with the cylinders and pistons preheated. The air charge, from the moment of its entry into the cylinder, picks up heat from the containing walls and continues to do so during at least 70 per cent of the compression stroke, with the result that the temperature necessary for firing with certainty the first injected charge of fuel is reached with a compression pressure 50 per cent less than that required in a Diesel engine.

This fact is far reaching in its importance, for it gives to the designer great elasticity and freedom of application, for a Still heavy oil engine can be designed for constant pressure or constant volume, or both can be employed in the same engine by correct timing of the fuel injection. It claims for its combustion cycle an efficiency higher than that of the Diesel, less weight and space per horsepower, and for its combined cycle an efficiency not less than 20 per cent higher than any prime mover which uses fuel as its source of heat.

The first engine designed for the use of heavy oil was of the opposed piston type, 16-inch diameter, 32-inch total stroke, revolutions 150, the combustion taking place between the two pistons with the steam generated by the jacket water and exhaust gases expanded at the back of both pistons—the steam passed from the auxiliary boiler through high-pressure and intermediate-pressure cylinders, and finally to the Still engine as a low-pressure cylinder—and thence to the condenser.

In a special engine subsequently constructed to meet special conditions—where the maximum power in minimum space was the main desideratum—the dimensions of the cylinder were: Bore, 13½ inches, stroke 22 inches; two-stroke cycle, opposed pistons; steam side as for low-pressure cylinder. It forms the basis of a six-cylinder set, two of them using high-pressure steam, which is compounded into the other four as low pressure.

The combustion takes place between the pistons, the steam acting on the return stroke at the back of both pistons. After a series of preliminary tests under steam alone, in which data was obtained for the various mechanical adjustments, the scavenge, compression pressures and temperatures, at various speeds, oil was injected for the first time. The engine fired its first charge without hesitation, and completed a series of tests of over two hours' continuous running, without adjustment, giving an output by gradually increasing the weight of oil admitted of 100, 150, 200, etc., up to 400 indicated horsepower at a maximum speed of 380 revolutions per minute, for which she was designed.

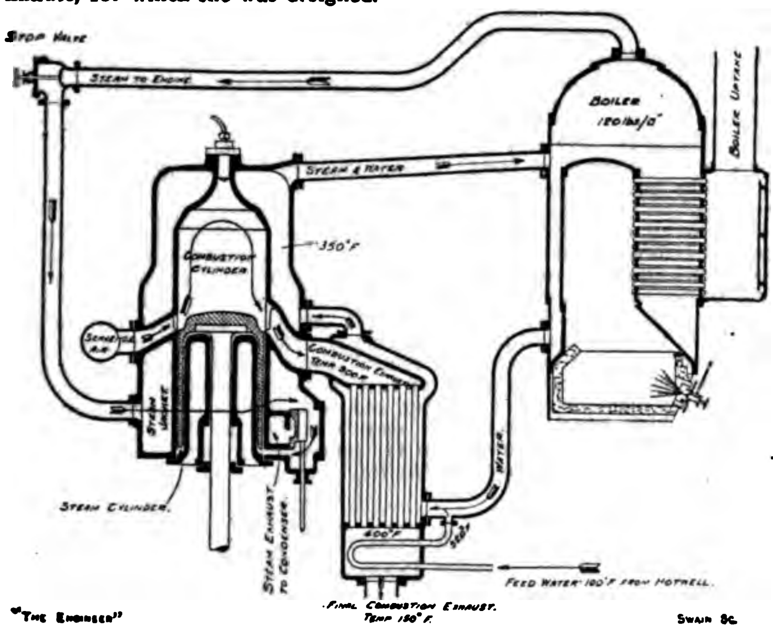


DIAGRAM SHOWING ARRANGEMENT OF STILL ENGINE.

This unit has been subjected to many long and varied tests by representatives of various governments, as well as to constant research work under severe conditions. Its best consumption of fuel—Admiralty shale oil—has been as low as .302 pound per brake horsepower—scavenge pump not included—over a test of one hour's duration under normal waste heat conditions. It developed 330 brake horsepower for six hours at 360 revolutions per minute—a single cylinder—under waste heat conditions. It will develop 400 brake horsepower continuously with added steam, and has developed 540 brake horsepower at 380 revolutions over short periods. (Combustion mean effective pressure 128.2 pounds, steam mean effective pressure 57.9 pounds, total mean effective pressure 186.6 pounds.) The thermal brake efficiency from below quarter load to full power is maintained at approximately 40 per cent over the whole range.

With added steam from the boiler 5000 brake horsepower would be obtained from two 6-cylinder sets, with a weight of about 70 tons, including all auxiliaries and water, and extreme overloads up to 6000 brake horsepower could be obtained.

The application of the Still system to commercial marine work is being developed in this country and abroad, the two-stroke single-piston type, in powers of 100 horsepower per cylinder and 400 horsepower per cylinder, having been adopted.

Engines of this type at 120 revolutions per minute, with a cylinder 22 inches diameter by 36 inches stroke, giving 4200 shaft horsepower on two shafts, with all auxiliaries and water, would approximate 600 tons. A geared turbine plant in a similar ship would weigh 20 per cent more, and would consume approximately 2000 tons more fuel for a double journey lasting 1000 hours.

Locomotives.—The success already achieved in proving the principles to be correct, both in theory and practice, has led to a careful study, both here and abroad, into the application of this sysetm to locomotive work. No high-powered locomotive engine, using heavy oil or gas in its cylinders, has been produced capable of economical haulage of heavy loads.

A Still engine designed for locomotive work would be capable of giving an efficiency at the rails of 30 per cent over 90 per cent of its running time—in other words, six times as good as the present locomotive; while during the accelerating period its efficiency would be at least 15 per cent, or three itmes as good. In surmounting long inclines with heavy loads, the engine would be capable of developing about four times the power which it develops at its most efficient or normal running load.

It is surely not unreasonable to expect that the application of the system here described should be put, without delay, to practical test for locomotive work, and especially so in view of the development and enormous expenditure contemplated in the electrification of railways. To give up the unit system of traction where the failure of one unit does not involve the failure of the whole, and to rely on what is, after all, a delicate and easily dislocated source of energy from central-power stations, merely to gain a problematical 6 per cent increase of fuel efficiency, seems to involve a risk far greater than the encouragement and development of novel forms of engines, which, whether gas or oil, may be evolved at the present rate of progress before the country is too far committed to such a gigantic and possibly dangerous experiment.—*The Engineer,* 5/30.

AERONAUTICS

TWELVE PER CENT AMERICAN PLANES AT WEST FRONT WHEN WAR ENDED.—The following statement was prepared by Statistics Branch of the General Staff:

COMPARISON OF AEROPLANE STRENGTH OF ALLIES AND ENEMY AIR SERVICE AT DATE OF ARMISTICE

French and Belgian front	Number of Planes
French	3,321
German	2,730
British	1,758
American	740
Belgian	153
Total Allied	5,972
Total Enemy	2,730
Italian front	
Italian	812
Austrian	622

COMPARISON OF BALLOON STRENGTH OF ALLIED AND ENEMY AIR SERVICES AT DATE OF ARMISTICE

French and Belgian front	Number of Balloons
German	170
French	72
British	43
American	23
Belgian	6
Total Allied	144
Total Enemy	170
Italian front	
Italian	32
Austrian	26

—*Aerial Age Weekly*, 6/9.

ONE-STOP TRANS-CONTINENTAL FLIGHT.—Plans for a trans-continental flight directed by the Operations Divisions of the Army Air Service have been completed. The start will be from New York city in a U. S. Martin bomber. The finish will be at San Francisco, Calif. The total distance is computed as 2750 miles, intended to be covered in two successive days. The only stop contemplated will be at North Platte, Neb., giving a first leg of 1502 miles, and a final leg from North Platte of 1248 miles. The pilots will be Capt. Roy N. Francis and Lieut. Edmund A. Clune, Air Service, assisted by two or three mechanics. The condition of the territory passed over will be tabulated for aerial routes. The reliability and the durability of the Liberty motors will be tested. The plane will be equipped with twin Liberty-12 motors, aggregating 800 horsepower.

The route passes over 13 states in a nearly direct air line. It passes from New York over the northern part of New Jersey, central Pennsylvania, northern Ohio, Indiana, Illinois, southern Iowa, central Nebraska, southern Wyoming, northern Utah, Nevada and California. The large cities en route are Cleveland, Toledo, Chicago, Des Moines, Omaha, Cheyenne, Salt Lake and Sacramento. The southern end of Lake Michigan is to be crossed, the Mississippi at Rock Island and Davenport, and the Missouri at Omaha. The highest land elevation en route is about 8000 feet. The last trans-continental flight made by the Air Service was that of Major Thomas C. Macauley, who doubled the southern continental route from San Diego, Calif., to Jacksonville, Fla., between April 12 and 18, a distance of 4642 miles in 2655 minutes flying time. He made several stops en route. His eastern flight, with the benefit of a western wind, was made in 19 hours and 15 minutes flying time. He used a DeHaviland-4 plane with a Liberty motor.

Capt. Roy N. Francis, Air Service, U. S. A., who is attempting the one-stop trans-continental flight from Mineola to San Francisco, is one of the foremost instructors of fliers in the United States. At Kelly Field, Texas, during the period of hostilities Captain Francis taught and trained more than 1500 men who qualified as military aviators, a greater number than any other American instructor so far as known, and probably more than any one foreign instructor. Since the armistice he has been performing regular flying duty and has taken on short flights groups of Senators and Representatives. Captain Francis did all that was humanly possible to have the War Department assign him to foreign service as a pilot, but his ability as an instructor was regarded as so valuable that he was disappointed in his ambition to fight the enemy in the air.—*Army and Navy Journal*, 6/7.

MISCELLANEOUS

JOFFRE EXPECTED 500,000 FROM U. S.—"I happened to remember the other day that when Marshal Joffre was in this country he and I had a very long, confidential conversation with regards to America's participation in the world war, and I asked the Chief of Staff if I could have a memorandum

of that conversation. I did not succeed in finding it, but I found a report of a conference between Marshal Joffre and the General Staff.

"This conference took place early in May, 1917. Marshal Joffre urged strongly that we immediately form a single division of troops and send them to France to stimulate the flagging spirits of the French. They had undertaken a great offensive, which had failed with a tremendous and disheartening loss of life; and he felt that nothing would serve to revive that flagging morale more than the appearance of the American soldiers at the front.

"He urged that we should form a great army, with the expectation of ultimately participating in great force on the western front. He said that a port would be placed exclusively for our disposal and that it would be adequate for our work for a very long time, more than adequate to land this single division and supplies—perhaps not quite adequate for our great army when it came, because, he said:

"'When your great army comes, you will have 400,000, perhaps as many as 500,000 men, and you will need more port facilities for them.'

"The wildest expectation of the French General Staff was that, when America finally did pull herself together and prepare to participate on the western front, we would have as many as 400,000 to 500,000 men. As compared with the performances of a great army of 400,000 or 500,000 men the thing which America finally did was that in June, one year and two months after we declared war, we were selecting, training, equipping, transporting, and maintaining soldiers in France at the rate of 10,000 a day. In the single month of June, 1918, we transported nearly as many men as the Marshal had expected us to put in our great army as the maximum of his great expectation. And, when the armistice did come to pass, we had in France over 2,000,000 men and our casualties on the western front were pretty nearly as great as the maximum expectation of the Marshal for our entire army.—From speech by Secretary Baker in New York, *N. Y. Times*, 6/13.

TO SURVEY NORTHERN PACIFIC WATERS.—There entered the Pacific Ocean through the Panama Canal recently the Government's new vessel built for the Coast and Geodetic Survey, very properly named the *Surveyor*, en route for Alaska from Norfolk, Va. She is probably the most modern ocean-going surveying vessel in existence. She is a steel, steam vessel of 1000 tons displacement, of 1321 indicated horsepower, and has a speed of 12 knots. Her complement is 11 officers and 56 men. She was designed along lines that would give her the maximum possible seaworthiness, steaming radius, and maneuvering qualities in a craft of her size. High speed was not considered essential, but was sacrificed for steadiness and seaworthiness.—*Nautical Gazette*, 6/14.

CURRENT NAVAL AND PROFESSIONAL PAPERS

Civil Engineering in the War. Work overseas. Major-Gen. Sir G. R. Scott-Moncrieff. (*Times Engineering Supplement*, May, 1919.)

Panama Canal-Zone Dry Docks and Repair Shops. R. D. Gatewood. Illus. (*American Machinist* [European Edit.], May 3, 1919.)

The French Army Motor Service: Its Organization and Working during the War. (*Génie Civil*, Apr. 12, 1919.)

New Orleans Army Base Improves Facilities of the Port. G. H. Davis. Three concrete warehouses tied to 2000-foot wharfhouse on river by bridge permitting access to all floors. Rail and water connections and storage facilities make peace-time use important. Illus. (*Engineering News-Record*, Apr. 24, 1919.)

Railway Gun Mounts. Lieut.-Col. C. M. Barnes. Illus. (*American Machinist* [European Edit.], May 3, 1919.)

New Express Locomotive with "Uniflow" Cylinders, North Eastern Railway. A class "Z" 3-cylinder engine which will provide a useful comparison with others of the same series, but having ordinary ported cylinders. Illus. (*Railway Gazette*, May 9, 1919.)

Special Train for the Commander-in-Chief in France. Illus. (*Railway Gazette*, May 9, 1919.)

Ford Methods in Ship Manufacture. Electric rivet heating and welding, flame cutting and boring propeller shaft bearings. Serial. F. E. Rogers. (*Industrial Management*, May, 1919.)

The Building of Concrete Ships. The "Monolithic" and "Unit" systems. Illus. (*Modern Transport*, May 17, 1919.)

The Kitchen Reversing Rudder. Illus. (*Engineering*, May 16, 1919.)

War-Time Repairs in the American Navy, Boring and Lining Operations. This article explains the principal features of the system for taking care of the many jobs handled by the repair ship. Relining a set of connecting-rod brasses is also described, together with details connected with the necessary boring of the lining. The method of setting up the work on the horizontal boring machine is given. Serial. Illus. F. A. Stanley (*American Machinist* [European Edit.], May 10, 1919.)

Electrically-driven Ships' Auxiliaries. Illus. (*The Engineer*, May 16, 1919.)

Marine Boilers Standardized. Some critical comments. (*Times Engineering Supplement*, May, 1919.)

Water-Tube Boilers for Cargo Ships. (*The Engineer*, May 16, 1919.)

Modern Marine Engine Economies. Some notes on the efficient operation of ships' engines and boilers. (*Shipbuilding and Shipping Record*, May 8, 1919.)

Civil Aviation and the Air Routes of Great Britain. Map. (*Flight*, May 1, 1919.)

Air Navigation. The most important of the unsolved problems relating to aviation. Major H. E. Wimperis. Map. Diagrams. (*Aeronautics*, May 8, 1919.)

Medical and Surgical Aspects of Aviation. H. Graeme Anderson. (*Aeronautics*, May 8, 1919.)

Engineering Achievements of the U. S. Army. (*Mechanical Engineering*. April, 1919.)

Reorganization of the American Engineering Standards Committee. Serial; Erit. B. Rosa. (*Engineering News-Record*, May 1, 1919.)

DIPLOMATIC NOTES

FROM MAY 20 TO JUNE 20

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

GERMANY ACCEPTS PEACE TERMS

DISCUSSION EXTENDED TO MAY 29.—At the request of the German delegation, the time accorded for discussion of peace terms was on May 20 extended seven days, from May 22 to May 29. The request was based on the ground that the German delegation had in preparation several notes containing suggestions of a practical character which could not be completed in the period of 15 days originally allotted. These were listed as follows by Count von Brockendorff-Rantzau in his request of May 20:

> First—a note concerning territorial questions in the east; second, a note concerning Alsace-Lorraine; third, a note concerning the occupied territories; fourth, a note concerning the extent and discharge of the obligation undertaken by Germany in view of reparation; fifth, a note concerning the further practical treatment of the question of labor laws; sixth, a note concerning the treatment of German private property in enemy countries.

These notes were submitted, but their contents were for the most part covered in the general reply sent by Germany on May 29.

In the American press of May 24 appeared the full text of the German communication (May 16) regarding the effect of the peace terms on the German people, and also the reply of the Allies (May 22). To the complaints of Germany, the Allies replied: (1) That the peace terms reduced the population of Germany from 67 million to 61 million; (2) that the four million tons of shipping taken from Germany constituted less than one-third of the tonnage sunk by submarines; (3) that Germany could import goods and still be prosperous; and (4) that in general the hardships laid upon Germany were the result and just punishment of her own acts.

The text of the German note on boundaries (May 15) and on the Sarre Basin (May 16), together with the replies of the Allies (May 24), was published in the American press of May 26. Certain alterations in these matters appeared in the final terms.

GERMAN REPLY OF MAY 29.—The German reply to the peace terms submitted on May 7 was received on May 29. The covering letter of Count von Brockendorff-Rantzau appeared in the American press of June 2, and a summary of the entire note on June 16. The note contained about 60,000 words.

The covering letter was in effect a summary of the entire reply. It declared that the terms were "impossible," "more than the German people can bear," and that "Germany, thus cut in pieces and weakened, must declare

herself ready in principle to bear all the war expenses of her enemies, which would exceed many times over the total amount of German public and private assets."

The reply begins with an analysis of the legal basis of peace, alleges a flagrant series of contradictions to this basis and points out that the results would be the complete enslavement of the German people and the betrayal of all the world's cherished hopes of peace.

In the counter proposals Germany demands immediate admission to the league of nations as part of the spirit of the armistice agreement and as necessary for the acceptance of the proposed military, naval and air terms. She then analyzes the territorial changes demanded, claiming that the right of self-determination has been wilfully violated throughout.

Germany bitterly assails the abolition of all German rights outside of Europe as irreconcilable with the preliminary negotiations and as wholly impossible to a great people, who not only have supreme needs for markets and supplies, but who have shown themselves capable of sharing the world's colonization.—*Associated Press,* June 15.

FINAL TERMS SUBMITTED ON JUNE 16.—The reply of the allied and associated powers containing the final terms to Germany was handed to the German delegates and made public on June 16, with a period of five days (extended later to seven) for acceptance or rejection. The principles of the original terms were followed out, with modifications in detail and explanations. The changes included:

A plebiscite for upper Silesia, with guarantees of coal from that territory.

Frontier rectifications in West Prussia.

Omission of the third zone in the Schleswig plebiscite.

Temporary increase of the German Army, from 100,000 to 200,000 men.

Declaration of the intention to submit within a month of signature a list of those accused of violations of the laws and customs of war.

Offer to cooperate with a German commission on reparations and to receive suggestions for discharging the obligation.

Certain detailed modifications in the finance, economic and ports and waterways clauses, including abolition of the proposed Kiel Canal Commission.

Assurance of membership in the League of Nations in the early future, if Germany fulfills her obligations.

CONDITIONS FOR ADMISSION TO LEAGUE OF NATIONS—The conditions for Germany's admission to the League of Nations were inserted in the treaty on the basis of a report submitted by Lord Robert Cecil and Colonel House, as follows:

First—The establishment of a stable government.

Second—The signing of the treaty of peace.

Third—The loyal execution of the peace treaty.

A proposed fourth condition relative to Germany's abolishing compulsory military service was finally omitted on Premier Clemenceau's suggestion. It was considered that the treaty sufficiently provided for Germany's disarmament.

GERMANY'S REPLY.—Immediately upon receiving the final terms, the German delegates left for Weimar, where a meeting of the German cabinet was held on June 17, in preparation for submitting the German answer to the national assembly.

U. S. SENATE SEEKS PART IN NEGOTIATIONS

INVESTIGATION OF TREATY "LEAK."—On June 6, following statements by Senators Lodge and Borah that several copies of the Peace Treaty were in circulation in New York and elsewhere, the Senate passed a resolution introduced by Senator Hitchcock for an investigation of the treaty "leak." Subsequent testimony revealed that a copy had been given to Mr. Henry P. Davison upon his return to New York by Mr. Thomas W. Lamont, associated with the American delegation as a financial expert. Ex-Senator Root pointed out to the Senate Investigating Committee that, upon its publication by Germany, the treaty was no longer a private document.

To the Senate's request for a copy of the treaty, President Wilson on June 16 replied through the Secretary of State that "it would not be in the public interest to communicate officially to the Senate a text which is provisional and not definite, and he finds no precedent for such a procedure."

KNOX RESOLUTION AGAINST LEAGUE OF NATIONS.—Senator Knox, on June 11, introduced in the Senate a resolution expressing opposition to any treaty provision which would in effect amend the Constitution of the United States, and advising that the treaty be so drawn as to permit states to ratify without taking action regarding the League of Nations. This resolution was favorably reported by the Committee on Foreign Affairs, but was not put to a vote in the Senate.

RESOLUTION FOR IRISH HEARING.—On June 6 the Senate passed a resolution requesting the American Peace Delegation to secure a hearing for the cause of Ireland before the Peace Conference. According to reports from Paris, it was the President's intention to submit this request without comment.

PEACE TERMS TO AUSTRIA

DR. RENNER'S ADDRESS.—The Allies presented peace terms to the Austrian delegates at St. Germain on June 2. By his reply, delivered standing and in French, Dr. Karl Renner, the chairman of the Austrian delegation, made a favorable impression. He referred to the Austrian republic as completely divorced from the old Hapsburg monarchy, and as one of eight nationalities which had "over-night created their own parliaments, their own governments, their own armies, in short, their own independent states."

Regarding Austria's relations with other former parts of the empire and with the Allies, he spoke as follows:

> Between them and us it is not a question of making peace, but of liquidating the former partnership and settling the future relations under the intervention and guarantee of the powers, for which we pray. Nevertheless, these succeeding states, meeting face to face in Paris, play quite a different rôle in regard to their obligations assumed in the past. We expect to eliminate this contradiction at the Peace Conference. I reserve to myself the opportunity of drawing like conclusions from this contradiction later on.
>
> We are before you as one of the parts of the vanquished and fallen empire. We assume our portion of the liabilities, growing out of these our relations to the Allied powers, and we are well aware of the fact that our fate is resting in your hands.

We hope and believe that the conscience of the world shall not deny to our people, nor curtail, the inalienable right of self-determination, which the associated powers have always proclaimed to be the very aim of their war waged against the Hapsburg and the Hohenzollern monarchies, a right which our people, confiding in the principles recognized by the Allied powers, have adopted as a fundamental basis of their new constitution.

We trust that the world's common sense will not have in view, nor will permit, our economic ruin. The destruction of the economic unit of the monarchy, the separation of our mountainous country from all its national resources, has condemned us, these last six months, to privations which are by far exceeding the sufferings endured in war time.

The latter part of the address suggested Austria's desire to unite with Germany, as a matter of economic necessity. Having received the treaty terms, the Austrian delegates returned to Innsbruck for a conference with members of their government. After Germany's example, June 6 was declared a day of mourning over the peace requirements.

TERMS OF PEACE.—While the officially published summary of the Austrian peace terms was marked chiefly by its omissions, it revealed that the military terms and those relating to the League of Nations were in general identical with those offered to Germany. Details of frontiers, especially the Italian, were for the most part omitted. Provision was made for the rights of minority peoples in the various new states. A summary follows:

The treaty will consist of a preamble and 14 parts, the preamble and Section I embodying the covenant of the League of Nations, as in the treaty with Germany.

Part II deals with frontiers. The boundary between Austria and Czecho-Slovakia follows practically the old Bohemian frontier, although with the reservation of a possibility of making minor changes later. Austria retains on the west her old frontier with Switzerland, the question of the union of Voralsberg with Switzerland having apparently been dropped, despite the plebiscites already undertaken in that province and Switzerland. The southern frontier is not determined in the treaty.

Part III contains political clauses, including also some of the reserved geographical provisos, and clauses establishing mixed commissions to determine them later.

The sections referring to Italy are all omitted.

Others deal with the future relations of Austria with Czecho-Slovakia, Jugo-Slavia, Poland, Hungary and Russia. Here are found the stipulations for the protection of racial minorities, which, so far as the minorities in Austria are concerned, are to be embodied in a "bill of rights," as part of the Austrian Constitution.

Then come parts dealing with Austria's renunciation of all rights outside of Europe, military, naval and aerial armaments, which hereafter will entail virtually no expense for Austria, and the return of prisoners of war.

Part VIII, on reparations, is blank. Part IX, dealing with finance, may be changed as a result of the representations of the new states. The economic clauses and aerial navigation regulations are identical with those in the German treaty.

Part XII, on ports, waterways and railways, provides for commercial outlets southward by water and rail. These details have already been covered in the report of the Inter-Allied Ports, Waterways and Railways Commission. Part XIII contains the international labor convention, and Part XIV various miscellaneous provisions of minor importance.

BELA KUN REPLIES TO PEACE CONFERENCE NOTE.—In reply to a note from President Clemenceau, the contents of which were not revealed, Bela Kun, the Hungarian Communist Foreign Minister, expressed his willingness to cease hostilities with the Czecho-Slovaks, although he claimed that the Czecho-Slovaks themselves were responsible for violations of the frontier established by the Allies. The Hungarian leader suggested the appointment of a commission to settle these disputes, and closed by expressing satisfaction that the Allies had invited Hungary to the conference.

In Paris circles it was not admitted that a direct invitation had been extended to Bela Kun, nor was it regarded as certain that he would cease hostilities undertaken " for the liberation of the Czecho-Slovak proletariat."

SCHEME FOR RHINE REPUBLIC

Apparently with the sanction of French military and political authorities, a Rhenish republic was proclaimed at Wiesbaden on June 1. Dr. Dorten, a former state's attorney, became head of the new government and sent telegrams to the Paris Conference on June 2 announcing the proclamation of the republic by delegates assembled at Wiesbaden, and declaring popular support for the movement. As shown by later developments and reports from American sectors in the Rhineland, there was in reality little popular sympathy behind the move to separate the Rhine provinces from the rest of Germany.

PROTESTS FROM BERLIN.—Berlin, June 3 (Associated Press).—The German Armistice Commission has handed to Marshal Foch a note for the Allied powers protesting against French support of the proclamation of a Rhenish republic as high treason against Germany, and complaining of Colonel Pinot's threats and actions at Weisbaden. The note concludes:

" This action on the part of the French occupation authorities is in sharpest contradiction to the armistice conditions and represents the grossest violation of obligations legally undertaken. The German Government makes the sharpest protest against this behavior."

In response to Dr. Dorten's notification of the proclamation of a republic, the German Chancellor, Philipp Scheidmann, has ordered the prosecution of Dorten and the other members of his government for high treason, and has declared all the official acts of the new government void.—*N. Y. Times*, 4/6.

ASSERT FOCH'S APPROVAL.—The only support in Germany for the separatist movement seems to have come from members of the Catholic center party. According to a Mannheim despatch of June 4, General Gerard of the French Army was approached in the matter by two Centrist members of the National Assembly on March 8. The delegates received assurances of protection from French authorities, including Marshal Foch, who was quoted as declaring the establishment of one or more independent Rhine states inevitable.

The Berlin government on June 6 appointed Karl Trimborn, a leading member of the Centrist Party, as regional president of the Rhineland. This was regarded as a concession to republican sentiment in the Rhine country, and as a counter-measure against the separation movement.

RUSSIA

ALLIES PLEDGE SUPPORT TO KOLCHAK.—On May 26 the allied and associated powers sent to the All-Russian Government at Omsk a note which, it is understood, offered the Omsk Government support, including munitions and supplies, on condition that the Omsk Government should accept the decisions of the Peace Conference and assure self-government in Russia.

To the terms of this note, Admiral Kolchak gave a conditional acceptance, summarized as follows:

Paris, June 7 (Associated Press).—Further details of the reply of Admiral Kolchak, head of the government at Omsk, to the Entente conditions for the recognition of his government became known to-day. He has made two exceptions to the proposals. He agrees to call a Constituent Assembly with full powers, but takes exception to the alternative in the Entente offer that the old Constituent Assembly elected in 1917 should be recalled in case it proves impossible to form a new one immediately after his arrival in Moscow.

He declares that the old Constituent Assembly was elected irregularly, before the Bolshevist doctrines were discredited, and, consequently, the members elected are not representative of present-day Russia.

He also takes exception to the provision that Finland as an independent state shall be represented, stating that this is a matter on which the Constituent Assembly must decide.

He concedes Polish independence, as that was approved by a democratic Russian Government, functioning regularly.

According to the Havas Agency, Admiral Kolchak says that while his government has already recognized the independence of Poland, the final frontiers will have to be adjusted by mutual agreement, and that his government will accept the assistance of the various non-Bolshevist governments in solving the difficulties during the period of transition prior to the establishment of a regular government.

Concerning the Russian debts, Admiral Kolchak reiterates the decision of his government to pay all debts contracted by the various governments up to the Bolshevist revolution of November, 1917.

ALLIES' NOTE OF JUNE 12.—Paris, June 12 (Associated Press).—The reply sent by the Council of Four to-day to the note of Admiral Kolchak extends to him and his associates in the All-Russian Government at Omsk what is interpreted here as de facto recognition. The note reads:

"The allied and associated powers wish to acknowledge the receipt of Admiral Kolchak's reply to their note of May 26. They welcome the terms of that reply, which seem to them to be in substantial agreement with the propositions they had made and to contain satisfactory assurances for the freedom, self-government and peace of the Russian people and their neighbors.

"They are therefore willing to extend to Admiral Kolchak and his associates the support set forth in their original letter.

LLOYD GEORGE,
WILSON,
CLEMENCEAU,
MAKINO."

It is understood that the support referred to involves the furnishing of munitions and supplies for Admiral Kolchak's campaign.

The Havas Agency says Premier Orlando of Italy also signed the document.

An official statement issued by Admiral Kolchak states that he has appointed a commission, headed by M. Billareugsoff, to make a study of constitutional questions preparatory to the framing of a constitution which will be submitted to the proposed Constituent Assembly.—*N. Y. World*, 13/6.

AMERICANS LEAVE NORTH RUSSIA.—According to an Archangel despatch of June 6 all the American forces will be withdrawn from the North Russian front by the last of June. The second contingent to leave was then assembled at Economia, the winter port of Archangel, and was expected to sail within 10 days. The total casualties of American forces on the North Russian front was stated to be 556.

FAR EAST

CHINA WILL SIGN TREATY, WITH RESERVATIONS ON SHANTUNG.—Paris, May 24.—Luther G. Chang and C. E. Wang, two of the ranking Chinese delegates, said today that they would probably sign the Peace Treaty with a reservation stating that they did not waive their claim for the transfer of German rights in Shantung to China direct and did not recognize the transfer to Japan.

The Chinese are unable to sign the treaty without reserve because the situation in China is acute, but they are eager to see China become a member of the League of Nations and to share the benefits resulting from the opium agreement.

Anti-Japanese agitation increased in China with the announcement of the treaty terms relating to Shantung. Mass meetings assembled in various cities, and it was reported that all institutions of learning in Pekin had gone on strike in protest. A boycott of "enemy" Japanese goods was declared at Shanghai and other ports. According to a Tokio despatch of June 11 several Japanese warships had been sent to Shanghai.

ALLIES ASSURED OF PEACE IN CHINA.—Peking, June 6 (Associated Press). —The British Minister, Sir John N. Jordan, on behalf of the diplomatic body in Peking, yesterday tendered an aide memoire to President Hsu Shih-chang, in which the powers expressed deep regret at the suspension of the Shanghai Conference which had been endeavoring to effect conciliation between North and South China.

In reply President Hsu Shih-chang stated that, although the Shanghai Conference had come to a standstill, the negotiations for peace between North and South China were still in progress. The President assured the British Minister that the government was determined to secure peace, and that it was impossible that hostilities would be resumed.—*N. Y. Times*, 8/6.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"The Battle of Eastleigh, England." By the members of the U. S. N. A. F. stationed at Eastleigh, England. Price $2.50 net. (Published by Thomson Company, 9 Murray St., New York.)

In view of obstacles so successfuly overcome by the force that established and operated the assembly and repair base at Eastleigh, England, the title is appropriate, though the book contains little of blood and sudden death. It is a "Lucky Bag," compiled by the members of the U. S. N. A. F. stationed there, as a memento of their work and play from the establishment of the base, July 23, 1918, to its breaking up on December 2, 1918.

As with all such books, its appeal is principally to those to whom jokes on "Bill," or "Joe," there stationed, bring chuckles of remembrance. A large portion of the book is given up to short biographical sketches of the officers and chief petty officers of the station and to a muster-roll of the non-commissioned personnel. Short accounts are given of the work of the several departments, together with a short history of the establishment of the "Northern Bombing Group," leading up to the selection of Eastleigh as a sight for the assembly and repair base. The book is profusely illustrated with photographs of the station, of personnel and of planes.

L. A.

"Morals and Morale." By Luther H. Gulick.

It was said that many things, the submarine, the aeroplane, food, and even tobacco, would win the war, but the thing which really did the most for victory was the morale of the A. E. F. How the morale was dependent upon morals and the important part played by the Y. M. C. A. for this great cause, was the object of Luther H. Gulick in writing this book. The appearance of the book, after the death of the author, seems to give increased weight to his work for the welfare of the soldiers and sailors and entitles his thoughts and words in their behalf to greater consideration. Clean living is the essence of the book; the need of it and the efficiency of it are demonstrated among men who are training for winning a football game, as well as for winning the world's war. The following quotation is from the chapter on morals and morale, and is quoted because it shows the spirit of the subject in a few words: "The college man now who is playing on a big team and is struggling for the victory of his college, would face an outraged college spirit, if, before a great game, he indulged in dissipation, because he would by that act decrease the probability of a victory for his college." This good spirit is the morale of the team and

of the students, it is necessary for the fair name of their college; much more is it needed among the fighters for the fair name and glory of their country.

Never before, in all the wars of all the nations, has such stress been laid upon "cleanliness," and it is the first time that venereal diseases have been so recognized (not as a necessary evil), and so many steps taken to guard against them, as: general orders issued by the commander-in-chief, lectures and motion picture demonstration by medical officers, a special social hygiene division having been established for this purpose, and all the safeguards of the red triangle of the Y. M. C. A. having been thrown around the men. The result is now known to all the world, the war has been won and there is nothing but praise for the morals and morale of the Americans—but the work of the Y. M. C. A., at home and abroad, is not finished, but just begun in the larger field of reconstruction.

Read the book to find out what is planned to be done after victory for the future of Democracy and the welfare of the people of the world who have suffered so much from the lack of morals.

A. M. D. McC.

"Aviation Engines." By Lieut. (J. G.) John C. Chadwick, U. S. N. R. F. (Published by Edwin N. Appleton, Inc., New York City.)

This is a very small book setting forth briefly the main features and principles employed in internal combustion gasoline engines. The subject is treated in non-technical language and is arranged in a manner adapted for easy reading.

As stated by the author: "The purpose of this book is to give anyone desiring to operate an airplane, a fundamental understanding of engines as used. It is founded on the course of instructions as given at the U. S. Naval Aviation Detachment, Massachusetts Institute of Technology, in training pilots for service. It is not intended for purposes of design, criticism or recommendation, but simply for instruction of the average individual, assuming he knows nothing of a gas engine."

The author describes and gives the engine characteristics of three of the principal engines used in the field of aviation, including the Liberty, Curtiss and the Hispano-Suiza.

A very handy little "trouble chart" is included in the book.

W. L. L.

"Wrinkles in Practical Navigation." By S. T. S. Lecky. Eighteenth edition, revised and enlarged by William Allingham. 814 pages. Price $5. (D. Van Nostrand Company, New York.)

"Wrinkles" is a book so well known to every seafaring man that the eighteenth edition, revised and enlarged and printed by the Van Nostrand Company, New York, by arrangement with the English publishers, is assured of a hearty welcome by "all hands."

This edition contains a new chapter, entitled "New Meteorological Measures for Old," dealing in part with English *vs.* continental measures;

barometer and thermometer units, British and foreign; the centimeter, gramme, second system, etc.; also four new appendices as follows:

1. Substitute for Horizon.
2. Gyroscopic Compasses.
3. The Moon as Auxiliary.
4. Chronometers: Use and Abuse.

"Wrinkles" is a handy book for size, for the unique way in which the subject matter is presented, and for every seaman.

S. A. T.

"Simplified Navigation for Ships and Aircraft." By Chas. Lane Poor. 120 pages. (The Century Company, New York.)

This book, with a foreword by Rear Admiral Bradley A. Fiske, U. S. N., is one of the pioneer books in connection with aircraft navigation. It is based on the Saint-Hilaire method, and, in the words of the author, "Attempts to explain in non-technical language and without the use of complicated mathematical formulas the principles that form the basis of modern navigational methods." The book contains illustrations of a line of position computer with examples worked in connection therewith and would be interesting and valuable to any navigator.

S. A. T.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,

Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

Suggested by Request of the Board of Control

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"**The Naval Policy of the United States.**" Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CUIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887

The Naval Brigade: Its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888

Torpedoes. Prize Essay, 1888. By Lieut. Commander W. W. Reisinger, U. S. N.

1891

The Enlistment, Training and Organization of Crews for Our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892

Torpedo-boats: Their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894

The U. S. S. Vesuvius, with Special Reference to Her Pneumatic Battery. Prize Essay, 1894. By Lieut. Commander Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut. Commander Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention 1896. By Lieutenant John M. Ellicott, U. S. N.

1897

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut. Commander Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903

Gunnery in Our Navy. The Causes of Its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure Its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905

American Naval Policy. Prize, Essay 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear Admiral Stephen B. Luce, U. S. N.

1906

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut. Commander A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906 By Pay Inspector J. A. Mudd. U. S. N.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A Few Thoughts on Our Next Step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut. Commander Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENCE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut. Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotton, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut. Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut. Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut. Commander Dudley W. Knox, U. S. N.

1914

The Great Lesson from Nelson for To-day. Prize Essay, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

NAVAL POLICY AS IT RELATES TO THE SHORE ESTABLISHMENT AND THE MAINTENANCE OF THE FLEET. Honorable Mention, 1914. By Captain John Hood, U. S. N.

OLD PRINCIPLES AND MODERN APPLICATIONS. Honorable Mention, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

MILITARY PREPAREDNESS. Honorable Mention, 1914. By Naval Constructor Richard D. Gatewood, U. S. N.

1915

The Rôle of Doctrine in Naval Warfare. Prize Essay, 1915. By Lieut. Commander Dudley W. Knox, U. S. N.

AN AIR FLEET: OUR PRESSING NAVAL WANT. First Honorable Mention, 1915. By Lieut. Commander Thomas Drayton Parker, U. S. N.

TACTICS. Second Honorable Mention, 1915. By Ensign H. H. Frost, U. S. N.

DEFENCE AGAINST SURPRISE TORPEDO ATTACK. Third Honorable Mention, 1915. By Ensign R. T. Merrill, 2d, U. S. N.

1916

The Moral Factor in War. Prize Essay, 1916. By Lieutenant (J. G.) H. H. Frost, U. S. N.

NAVAL PERSONNEL. First Honorable Mention, 1916. By Lieut. Commander J. K. Taussig, U. S. N.

EDUCATION AT THE U. S. NAVAL ACADEMY. Second Honorable Mention, 1916. By Lieutenant Ridgely Hunt, U. S. N.

SOME UNDERLYING PRINCIPLES OF MORALE. Third Honorable Mention, 1916. By Commander Dudley W. Knox, U. S. N.

LARGE *vs.* A GREATER NUMBER OF SMALLER BATTLESHIPS. Lippincott Prize Essay. By Lieut. Commander Thomas Lee Johnson, U. S. N.

1917

Commerce Destroying in War. Prize Essay, 1917. By Commander Lyman A. Cotten, U. S. Navy.

THE PEOPLE'S RÔLE IN WAR. First Honorable Mention, 1917. By Lieutenant H. H. Frost, U. S. Navy.

THE NATION'S GREATEST NEED. Second Honorable Mention, 1917. By Colonel Dion Williams, U. S. Marine Corps.

1918

Letters on Naval Tactics. Prize Essay, 1918. By Lieutenant H. H. Frost, U. S. N.

THE PREPAREDNESS OF THE FUTURE. First Honorable mention, 1918. By Commander H. O. Rittenhouse, U. S. N. Retired.

NAVAL STRATEGY. Second Honorable Mention, 1918. By Rear Admiral Bradley A. Fiske, U. S. N.

1919

MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.

SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

45 AUGUST 1919 No. 198

United States Naval Institute Proceedings

The writers only are responsible for the contents of their respective articles

CONTENTS

Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 8 August, 1919 Whole No. 198

United States Naval Institute Proceedings

PUBLISHED MONTHLY
EDITED BY S. A. TAFFINDER

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

CONTENTS

OFFICERS OF THE INSTITUTE

President

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

Vice-President

REAR ADMIRAL A. H. SCALES, U. S. NAVY

Secretary and Treasurer

COMMANDER S. A. TAFFINDER, U. S. NAVY

Board of Control

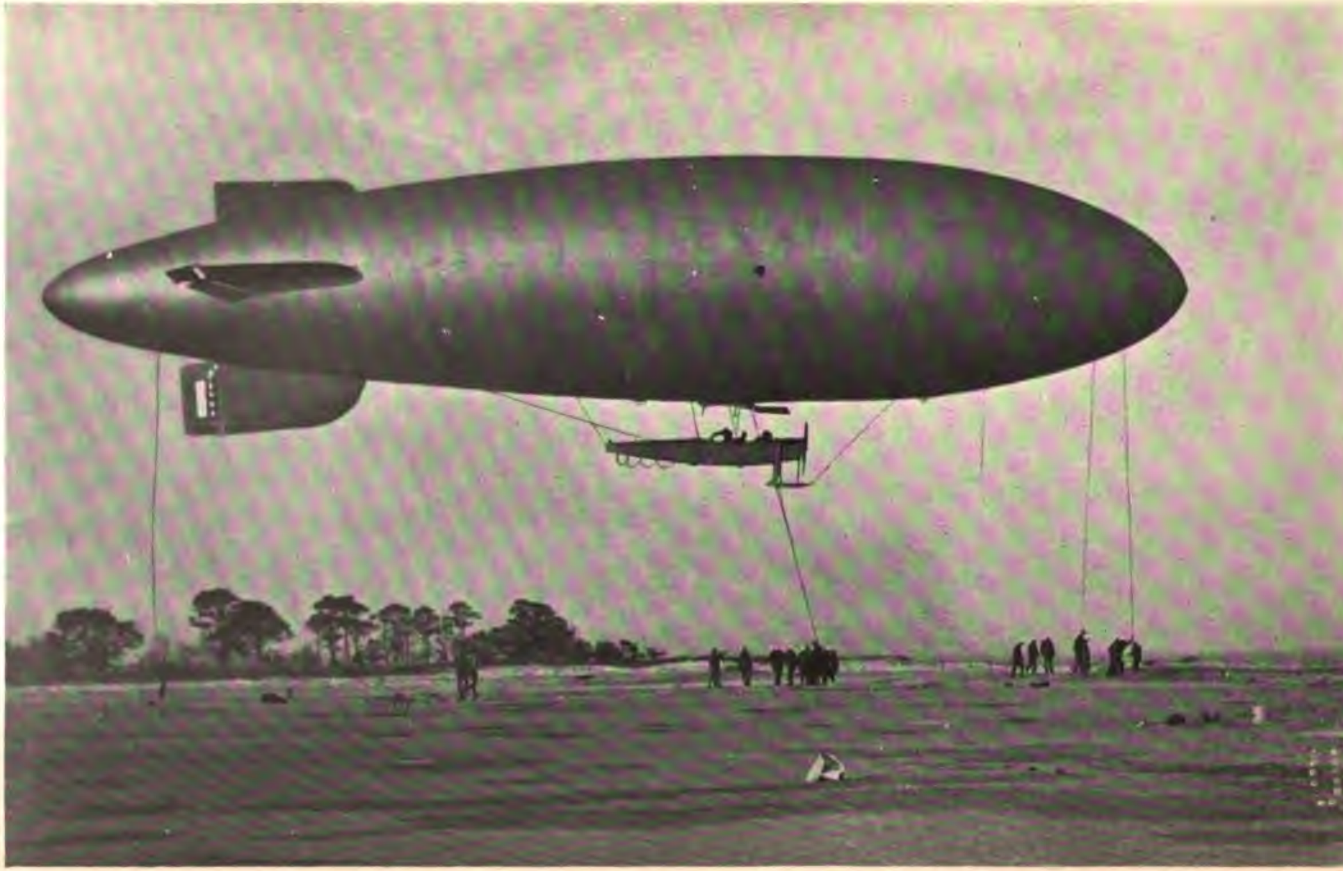
CAPTAIN DAVID POTTER, P. C., U. S. NAVY
CAPTAIN W. T. CLUVERIUS, U. S. NAVY
CAPTAIN T. L. JOHNSON, U. S. NAVY
CAPTAIN E. J. KING, U. S. NAVY
CAPTAIN W. G. DU BOSE, CONSTRUCTION CORPS, U. S. NAVY
COMMANDER S. A. TAFFINDER, U. S. NAVY (*ex officio*)

PAST PRESIDENTS

OF THE

U. S. NAVAL INSTITUTE

ADMIRAL DAVID D. PORTER, U. S. NAVY, 1873
REAR ADMIRAL JOHN L. WORDEN, U. S. NAVY, 1874
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1875–JAN. 1878
COMMODORE FOXHALL A. PARKER, U. S. NAVY, JAN. 1878–JAN. 1879
REAR ADMIRAL JOHN RODGERS, U. S. NAVY, JAN. 1879–JAN. 1882
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1882–JAN. 1883
REAR ADMIRAL THORNTON A. JENKINS, U. S. NAVY, JAN. 1883–OCT. 1885
REAR ADMIRAL EDWARD SIMPSON, U. S. NAVY, OCT. 1885–OCT. 1887
REAR ADMIRAL STEPHEN B. LUCE, U. S. NAVY, OCT. 1887–OCT. 1898
REAR ADMIRAL WM. T. SAMPSON, U. S. NAVY, OCT. 1898–OCT. 1902
REAR ADMIRAL H. C. TAYLOR, U. S. NAVY, OCT. 1902–OCT. 1904
REAR ADMIRAL C. F. GOODRICH, U. S. NAVY, OCT. 1904–OCT. 1909
REAR ADMIRAL RICHARD WAINWRIGHT, U. S. NAVY, OCT. 1909–OCT. 1911



LATE B CLASS SHIP OF IMPROVED ENVELOPE SHAPE, SINGLE RUDDERS, AND WITH APPENDAGES ELIMINATED. NOTE WIND SCOOP BEHIND PROPELLER ON BELLY OF ENVELOPE.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. 45, No. 8 AUGUST, 1919 Whole No. 198

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

OUR POST-WAR MISSION

By CAPTAIN D. W. KNOX, U. S. Navy

There is an ancient Chinese proverb, born out of countless ages of human experience, which says " Though all the world be at peace, if the art of war be forgot there is peril." To-day the example of China, herself, is a striking illustration of the folly of forgetting this wisdom, handed down by one of her own seers.

We are now at one of the most critical periods of history. A world nauseated with war wishes to abolish war for all time. Geographic, political and economic readjustments are to be made on the basis of a closer approach to fundamental justice than has been practicable in the past. Some form of international organization having in view primarily the prevention or the diminution of war, is likely to be established.

Probably these conditions and measures will succeed in at least prolonging the intervals of peace, and perhaps ultimately in preventing predatory war. But to assume that within a sensible time the probability of war can be eliminated wholly is to challenge reasoned judgment and appears to court disaster.

Certainly war will continue to harass mankind until its underlying causes are eradicated. Chief among these is *economic competition,* inevitably brought about by inherent conditions beyond the control of man; such as:

(a) Geographical position.

(b) Unequal distribution of natural resources—fertility of soil, minerals, natural highways, climate, fisheries, forests, harbors, etc.
(c) Racial development and decay.
(d) Overpopulation in certain areas; requiring abnormal provision for existence.
(e) The fact that governments must be formed for the common welfare and protection of communities; and that governments are inherently selfish organizations on account of the duties and obligations which they owe to their citizens.

Another important underlying cause of war is ***human nature;*** more especially in the following aspects:

(a) Strong racial antipathies.
(b) The instinct of self-preservation and of upholding what is conceived to be one's rights.
(c) The influence of habit upon opinions and prejudices; which inculcates dislike and conflicting ideas of right between peoples of different language, customs, religions, etc.
(d) Pride and ambition.
(e) The inherent desire in men to enrich themselves.
(f) Mass psychology, by which large numbers of people are swayed by leaders to take extreme measures when emotionally aroused.

Change in human nature is an evolutionary process so slow as to be all but inappreciable, and consequently this cause of war is not likely to disappear for some thousands of years.

There are constantly at work influences which tend to make war less probable. Among these are the gradual amalgamation of languages and races, a growing intercourse, sympathy, and understanding among men at large, and an increasing economic interdependence among nations. These and other changes doubtless will bring about ultimately greater political stability, but for many centuries to come "Though all the world be at peace, if the art of war be forgot there is peril."

CONDITIONS CONFRONTING THE NAVY IN THE IMMEDIATE FUTURE

Despite the basic principles referred to above, the world mind is so obsessed with a desire for peace that many people will be-

lieve in the permanent efficacy of measures adopted with the object of preventing war. The idealistic inclinations of Americans, our remoteness from Europe, and above all our freedom from compelling economic necessity, will serve to strengthen this fallacy in the United States and to enlist a larger proportion of adherents to it than in any European state.

Therefore less than ever can we expect to escape the cycle of events leading to unpreparedness, which has followed every war in American history.

First will come a period of financial retrenchment which must include a reduction of naval armament and expenditure. This is inevitable, and necessary for the national good; and naval officers will not dispute the wisdom of it unless the relative strength of our navy be reduced below that necessary to safeguard our national interests.

Then will follow a slackening of public interest in naval affairs. Normally this is a process brought about by awakened public attention to internal political, commercial, and other matters of peace-time occupation. But under the unusual conditions of a world organization to maintain peace, likely to be adopted soon, we must expect the American people to put aside all thought of naval affairs more impatiently than they have ever done before. The majority of them will never appreciate the essential difference between the spirit of the United States as a member of the League and the spirit of most of the other great members. Our country is rich, underpopulated, remote, and politically unified. European nations are face to face with grave economic problems involving sheer livelihood, the satisfactory solution of which is menaced constantly by the keen competition of close neighbors, foreign in blood, language, custom, and understanding. Perhaps we can hope for a Utopian world and afford to make sacrifices to that end; practical considerations prevent Europeans from doing so.

The indifference of the American public will be reflected inevitably in Congress, upon which the navy depends not only for appropriations but also for general legislation affecting intimately all aspects of naval preparedness and efficiency. In the near future we must expect inadequacy both of funds and laws, in many respects inimical to the navy's fitness for great emergencies.

The navy's present high prestige cannot be preserved long. We must look for a reversion to former conditions of hostility on

the part of some of the press and many citizens, both towards men and affairs. Those who advocate adequate naval preparation must be prepared to bear scathing attacks, in and out of Congress, upon their patriotism, honor and self respect.

Some politicians will take advantage of opportunities to exploit the navy for political ends, irrespective of the navy's interests and of the country's interests.

In peace, as in war, the moral support of the country towards its naval and military services is essential to a high standard of efficiency within those services. Neither officers nor men can give their best endeavors, however much they may strive, without a conviction that the country is behind them. Consequently under the adverse conditions outlined above as probable, we must expect our general efficiency to be impaired considerably.

Unless he shares in the popular illusion as to the efficacy of an International League to prevent war, it is manifestly the duty of every naval officer at this time, gravely to consider the methods by which the inevitable lowering of service efficiency may be minimized.

POST-WAR PREPAREDNESS

First let us consider those matters which are external to the navy. Since its inception the navy has taken an important part in the foreign affairs of the country. It is sometimes assumed that, with the advent of a degree of permanency, and consequent increased competency, of our diplomatic corps, together with improvements in communication by cable and radio, naval officers need not be so well versed as heretofore in matters which concern primarily the Department of State. This assumption is believed to be incorrect. Only within the last few months an American admiral was called upon to undertake a very delicate and complex diplomatic task in the Adriatic in connection with placing the Armistice into effect. He had practically no instructions and no definition of the policy of our government; because of the suddenness of the event and the difficulties of communication. Notwithstanding these handicaps and the handicap of having but very recently arrived on the scene, he anticipated his instructions correctly upon every occasion demanding immediate decision.

Diplomatic situations of importance confront officers of command rank in these days almost as frequently as in the old navy,

under circumstances which often prevent the timely receipt of instructions from the State Department.

Furthermore the assistance which the State Department itself has sought of naval officers during the difficult negotiations of the past four years indicates the necessity of naval officers keeping themselves prepared to serve the country well in the diplomatic sphere.

Post-war conditions will require more than ever that naval officers occupying high positions shall feel a responsibility to the country at large for leadership in naval affairs. Such a rôle is quite foreign to all the training of an officer during youth and middle age. As a junior officer and subordinate commander, even of high rank, naval tradition and training impel a feeling of loyalty and responsibility to the immediate superior only—a condition required by elementary military principles, except when the competency or rectitude of the superior is questionable. Consequently a naval officer almost invariably will extend to a civilian superior a high degree of loyalty and support, and will tend to consider himself responsible only to such civilian superior.

There can be no question as to the need, under these circumstances, for the officer giving his whole-hearted personal loyalty. If unable to do so he should resign from office. But the extent to which he should support the official actions of civilians, against his own convictions, is quite a different question. Presumption is against the competence of civilians to decide correctly many professional matters, or to furnish sound leadership in naval policy.

Congress and the country have a right to expect and do expect that naval affairs will be handled efficiently, and that the navy will be maintained in sufficient strength to defend the country against probable enemies and be kept in readiness to perform this mission whenever called upon. It necessarily follows that officers immediately subordinate to civilians have a dual responsibility—to the civilians and to the country. To carry out the latter will frequently require great tact and courage. If the officer is called upon to put into execution important instructions detrimental to the interests of the navy (and therefore the country) he should resign his position and the reasons therefor should be made public. Such procedure will frequently result in hardship for the officer, but this is one of the conditions inseparable from positions

of high responsibility when conscientiously filled. Uuless it be followed, especially during a long period of peace, when public watchfulness over naval affairs inevitably will be only casual, the navy's afficiency will suffer greatly, and the safety of the country be jeopardized.

Recently there have been suggestions that the navy should take over the manning and general administration of a part of the new American Merchant Marine, and should absorb the Coast Guard Service. Doubtless considerations of expediency will suggest in the near future that the navy should undertake other non-military functions. To a degree it is the duty and privilege of the navy to serve the country in any manner which exigency demands. But non-military duty is obviously a secondary mission of a service which exists primarily for the national defence and security, and it should be our concern to safeguard always the essentially military characteristics of the navy. If we become too engrossed in side issues our fitness to fight will suffer necessarily. If it be impossible to avoid undertaking secondary missions we should at least strive to make them temporary only, and endeavor that they shall not place our major mission in jeopardy.

In times of profound peace the danger of gettting into the grip of unpreparedness through slackened public interest in naval affairs, requires that a certain amount of publicity be given the navy constantly. The propriety of naval officers taking an active part, even in perfectly legitimate propaganda, is questionable, and may lead to doing the service more harm than good. The importance of the matter, however, together with the necessities of the case, will justify encouragement being given by officers to civilians who may desire to engage actively in this work.

We will pass now to a consideration of internal questions. We naval officers of this generation owe to our predecessors a great debt for establishing standards and traditions which will always keep the service close hauled in what might be termed peace efficiency—cleanliness, smartness, respectability, and general administrative excellence. This is the groundwork of discipline and a higher efficiency, and is a necessary prelude to effective operations in the sterner work of war. Similarly we inherit fine habits and traditions with respect to design, operation, and upkeep of matériel. All of this makes for highly efficient individual ships, and no navy in the world possesses better ones. It will be

necessary to uphold these standards in spite of serious handicaps that may come, and in view of the strong influence of habit upon human endeavor we may count with comparative confidence upon our ability so to do.

But obviously it is not enough to be proficient in peace work. It is not enough to have good individual units. We must keep ready to go to war on short notice, and to operate and fight the fleet as a whole efficiently. Leadership of the highest type is required to keep the navy in such a state of readiness during periods when the interest and whole-hearted support of the country is lacking.

One of the big lessons of the present war is that successful operations depend to a great extent upon good administrative support, which requires above all that the central authority, the Navy Department, be properly organized for war. Our situation in the department has been in the past analogous to that afloat—efficient individual units (bureaus and offices) without the ability properly to coordinate the whole organization in conformity with the administrative necessities of war.

An even more pronounced lesson of the great war is that success under modern conditions requires highly specialized General Staff work, including in addition to administrative functions those relating to planning, indoctrination, and other higher branches of the profession. Here again there is required a properly organized Navy Department to furnish the impulse to this form of efficient endeavor during war.

No criticism of the operations of the department during the present war is intended, in view of the difficulties with which it was confronted when the war broke out. But experience during long periods of peace has demonstrated conclusively the tendency to revert to an organization which will best serve peace activities, and to ignore the necessities which will be brought about inevitably by a condition of war. This tendency must be guarded against in the future. It is caused partly by the need for economy, and to that extent may be condoned if less excusable influences do not enter in combination with it. Another cause is the occasional personal ambition of heads of subdivisions in the organization, which leads to the over development of one function of the department at the expense of the others. The most serious cause of this tendency to revert to a peace organization however,

is the loss of perspective and the clouded conception of many officers as to the true rôle of various branches within the department and of the department itself; which can be prevented only by War College education of officers in general, including staff officers.

The department requires a permanent legalized office, similar to the office of operations, superior to and superimposed upon all bureaus, offices, and other subdivisions within the organization. This office should have sufficient authority and comprise adequate personnel to direct and coordinate all activities of the navy in peace and war. It should include functions relating to education, information, planning, and execution, as well as personnel, matériel, and inspection.

In modern warfare no fleet can be considered ready for battle unless the commanders of its units, even including those as small as destroyers, are well versed in the theory of their art, and are so indoctrinated as to be capable of timely coordination of effort in spite of delays in the receipt of instructions. No episode in naval history illustrates so conclusively as Jutland the need for this type of training in higher command. We must be prepared in the future for situations in which it is impossible for the commander-in-chief to keep himself informed of the actual situation to the minute, but which nevertheless require the collective effort of the fleet to be applied without loss of time in a manner which will insure coordination and mutual support between fleet units. Otherwise our fleet will be incapable of taking reasonable advantage of favorable tactical situations momentarily presented.

There is fresh in our memory the experience of the few years previous to the present war, of the evolution in the navy which was gradually bringing about a degree of higher training calculated to fit us for handling the fleet in action in the above manner. With the exception of the German Navy probably no other navy was so well advanced as ourselves in this important respect.

While the fleet must always be the finishing school for this kind of training, the War College course is a factor in the final result of even greater importance. So long as we have a navy we must preserve the War College and insist upon its being maintained actively as an integral part of the navy, in spite of any opposition which the future may bring about. Certainly it is the most economical part of the navy, since through it alone we can

count upon doubling the efficiency of our fleet; and no argument against it on the ground of economy, the great bugbear of efficiency during peace, should ever be permitted to prevail.

The maintenance of a high morale will be the most essential, and probably the most difficult problem to confront the naval officer during the coming peace. The vital part which morale plays in efficiency of fighting forces is well illustrated by the extremes of morale and efficiency through which recently we have seen some European forces pass within a short period. These difficulties ahead of us will be accentuated by the inevitable slackening of public interest in and support of the service, our lowered prestige in the public estimation, hostility to the navy by radical sections of the press, Congress, and the people, and other influences mentioned previously.

In order to maintain the morale of the service at large at a high level it is essential that the morale of the officer body should be exceedingly good.

The officer must cultivate and feel a patriotism which will transcend all personal questions and prepare him for every sacrifice, including the supreme sacrifice, which may be demanded by the interests of his country.

He must look for no reward other than the inward satisfaction derived from unselfish service in a great cause.

He must bear with fortitude the discouragements and disappointments which inevitably accompany the military service of a country temporarily engrossed in extraneous matters; remembering always, in spite of apparently contradictory evidence during peace, that the true spirit of a big nation can become manifest only in great crises; and that then he will be made aware of the country's loyal support of its defenders.

He must recognize and proudly accept his own responsibility, inseparable from his position as a naval officer, towards the country which has honored him with its confidence, and trusted him with its safety.

He must accept the doctrine that the form of government of our country is the most idealistic which will permit proper safeguards for stability and progress, during the present state of evolution of the race.

He must believe implicitly in those dictates of reason which prescribe adequate military preparedness as the best means of

insuring the nation's preservation and the general welfare of its people.

It is only by thus adjusting his inner consciousness and fundamental convictions, and by formulating for himself a creed of patriotic unselfish service, that the officer can become the embodiment of a high morale, and be capable of transmitting it to his subordinates.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ROOSEVELT MEMORIAL

By Rear Admiral Bradley A. Fiske, U. S. Navy

As we look back through the long corridor of history and see the countless millions crowded there, a very few figures stand high above the rest. Though these figures are seen differently from the standpoints of different men, most men could not help seeing Alexander, Cæsar, Charlemagne, Napoleon, and Washington. Among all these men and others, the figure which the world has declared to be the most perfect and symmetrical is that of Washington.

And now the world is becoming dimly conscious that America has produced another man preeminently great, and to feel that history may declare him a worthy successor of George Washington.

The things that Theodore Roosevelt did for the world are known by the world, and so are the positions that he held; but the things that he did and the positions that he held were because he was the man he was. Strong of mind and will and muscle; brave and kind and true; highly imaginative yet highly practical: audacious and yet cautious; ambitious, yet self-sacrificing; conscious of his talents and yet modest; aggressive and yet submissive; assertive of his own opinions, yet eager to hear those of others; possessing a wider range of knowledge than any other mortal of his time; discerning a straighter and wiser path of personal and national living than any other man; following it more rigidly and inspiring more people to follow it, Theodore Roosevelt stands a unique figure in the "corridors of time."

His active work is finished now: he personally can do no more Whether his influence shall continue or shall cease depends, not on him, but on us who live after him.

The Woman's Roosevelt Memorial Association is desirous of possessing the house in which he was born at 28 East 26th Street, New York, to be held, like Mount Vernon, as a continuous reminder to a people prone to be sordid that the life most worth living is a life of devotion to a noble cause. Among all the beneficiaries of his example, none are more indebted than navy men; none are more in honor bound to further the continuance of the inspiration of his life to those who shall come after.

Let us do what we can for his memory, in recognition of what he did for us. He was a friend of the navy when the navy needed friends.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

LETTERS ON STAFF DUTY

BASED ON EXPERIENCE ON THE STAFF OF A FLAG OFFICER AFLOAT

By Lieut. Commander Holloway H. Frost, U. S. Navy

Motto:

1. No commander can be successful whose time is occupied with administrative details.

2. Proper delegation of initiative to subordinates is the secret of successful command.

E. A. Anderson.

I. First Letter

THE HISTORICAL DEVELOPMENT OF THE STAFF

The French General Desaix, whom Bonaparte always considered the best of all the great soldiers who served under his orders, claimed that "the chief command of an army is the most difficult thing on earth: it is the one work above all others which requires the display of the greatest number of qualities in a given time." Had Desaix lived to-day, after the new idea of a general's staff had been developed, he would say that this holds good even more in the case of the chief of the staff than in that of the general or admiral in command. It applies to a lesser extent to the subordinate staff officers, especially in the case of a small staff, where each officer must perform a great variety of duties.

In the old days the general or admiral had a staff which was selected for far different qualities than a staff of to-day is selected for. The poor leader had a staff selected for show purposes: the officers were usually chosen from the nobility for the express purpose of gaining the favor of those high in authority in the same way that relatives and friends of politicians to-day are given easy and lucrative government positions. A good general, on the other hand, reduced this type of officer to the lowest number he

dared and selected what were considered in those days efficient staff officers. These were persons who would make good clerks or messengers; in addition, there were always a few of the picked officers of the entire army, to whom were given small bodies of troops for important distant operations, or who were assigned to hold an important key position or to lead a decisive charge in battle. The leader himself drew up all the plans and dictated the orders down to the finest detail.

This was the system of Marlborough and Eugene; of Turenne and Conde. Frederick, with all his genius, still held to it. The splendid Winterfeld—his chief-of-staff, and after Frederick, the finest German officer of that day—was noted for his brilliant conduct in distant raids and minor operations rather than for his careful planning of campaigns and the accurate arrangements for their execution—the duties of the chief-of-staff to-day.

Napoleon, as far as the staff work was concerned, followed closely in the steps of Frederick; perhaps he was influenced by his desire to keep his system, as he called it, secret; it was bad enough to have Jomini on the staff of one of his marshals; no such prying thinkers were wanted close at hand. The emperor was justified in this desire for secrecy, for when Jomini went over to the Russians he was able to give them the most important advice as to what Napoleon might be expected to do in certain situations. Therefore we see Chief Clerk Berthier acting as chief-of-staff and the intrepid Mouton or Rapp of the twenty-three wounds, leading the charges at critical moments. The small part played by Berthier is shown by the crude dispositions he made at the beginning of the 1809 campaign in Bavaria, when he commanded-in-chief for a short time, which proved that he had learned nothing of the system of the great leader with whom he had been so intimately associated for so many years.

It is true that with his system of doing everything himself the energetic General Bonaparte accomplished wonders with his small army, but this was due to his genius and wonderful activity. When the Emperor Napoleon began to campaign with his grand army, remarkable successes were still achieved, but when the forces grew larger and larger and the energy of the master diminished, the real faults of the system came to the light. No longer was it possible for one man—even had he been able to "put on the boots and the resolution of 1793"—to handle all the details;

and unfortunately there were no other officers trained for this duty. The Russian campaign displayed error after error; chance after chance was thrown away. You may remember that during the retreat there was one time when the Russian army coming north from the war with Turkey seized the line of the Beresina and commanded all its crossings, thus completely cutting the line of retreat of Napoleon's army. The emperor, facing the worst disaster of his career, aroused himself and made one of his most beautiful moves. By a rapid march he threw a force across the river, routed the Russians and built a bridge. Half the army passed in safety, but night coming on the movement stopped, there being no staff officers present to oversee such an important march. A cavalry officer noticed that no effort was being made to complete the crossing and tried in every way to get action taken. As no staff officers could be found, he himself forced several thousand stragglers to cross. In the morning the Russians appeared in greatly superior numbers and the stragglers, who numbered about 40,000, all attempted to cross at once, fighting desperately among themselves for a passage, so that thousands were pushed off the edge of the bridge and finally the bridge broke through, causing the terrible disaster which is so famous in history. All this could have been prevented by one good staff officer with authority to superintend the passage.

Again at the battle of Leipsic the lack of a proper staff was apparent. On the third day of the battle Napoleon was suddenly given the news that practically all the artillery ammunition was exhausted; this made a retreat necessary. There was but one permanent bridge over the small river in the rear of the army and no person had thought to build the numerous other bridges which would be necessary for the retreat of an army of one hundred and fifty thousand men. In addition to this neglect a mere sergeant was left in charge of the blowing up of this bridge after the rearguard had passed. Being alarmed by the approach of a few Saxon sharpshooters, he exploded the mine while there were still 25,000 men to pass, with what serious results you may imagine.

In the Waterloo campaign—so beautifully planned and so wretchedly executed—a whole series of mistakes were committed by the staff, which probably had a deciding effect on the result of the campaign. After giving the most detailed orders for the

first days, Napoleon gave both Ney and Grouchy—both of whom he knew to be incapable of using their own judgment on independent duty—very indefinite and unsatisfactory oral orders, so that neither had a proper understanding of his task. Later Grouchy sent an aid to Napoleon; although he arrived as the battle of Waterloo was commencing, he could get no orders for his general and was not even told that Napoleon proposed to fight a battle. I do not mean to defend Grouchy, for his mistakes were incomparably greater than those of Napoleon; for that matter the English were equally bad, and the Prussians none too good. I refer you to Ropes' splendid book "The Campaign of Waterloo" for a complete account of this terrible campaign; you will be pained to see the close competition between the three armies, each striving to make the worst mistakes.

When Napoleon was at St. Helena he made a very significant statement: "If I had to begin governing again I would not do precisely the same as I did then. I would look at things *en masse;* I would not bother myself about details." He recognized when too late the faults of his system!

I give to Scharnhorst the credit for developing the general staff idea. He was chief-of-staff to the Duke of Brunswick in the Jena campaign and had his sound advice been listened to, the complete defeat of the Prussian army might have been prevented. After the defeat of Prussia he became chief-of-staff to General Lestocq who commanded a Prussian corps in cooperation with the Russian army. His services were brilliant, the timely arrival of Lestocq's corps at Eylau giving Napoleon no more than a drawn battle where he had hoped for a decision. Later he had charge of the reorganization of the Prussian Army, and when war broke out again in 1813 he served as chief-of-staff to Marshal Blucher. He was ably assisted in his duties by Gneisenau and Muffling. Rugged old Blucher was well content to leave the planning of his operations in such efficient hands; all he claimed for himself was to be allowed to go into the thick of the fighting. Still even Scharnhorst was able to do no more than to introduce the new idea of a staff being of some real assistance to the general; unfortunately he was wounded in action and died; after that the Prussian staff work was far from brilliant. As an example, Muffling, the liaison officer with Wellington, stated before the Waterloo campaign that "the junction of the English

and Prussian armies for a defensive battle was so distinctly prescribed by circumstances and the locality that no doubt whatever could be raised on the point." You doubtless remember that there proved to be considerable doubt. Gneisenau also sent out an order to the corps commanders to concentrate without stating that hostilities were imminent. Bulow therefore marched along so leisurely that he arrived too late to take part in the battle of Ligny, a delay which had for a time a very dangerous result. However, after Blucher had been injured in a cavalry charge at Ligny, Gneisenau took the responsibility of ordering a change of base and a retreat on Wavre. This splendid move on his part made possible the march to Waterloo which decided the campaign.

After the Napoleonic wars Clausewitz developed the ideas which Scharnhorst had originated: Moltke brought them to their culmination and proved their worth in war. The general looked on things "*en masse*"—as Napoleon advised; the staff prepared the information necessary for the decision; the general indicated this in its broad outlines; the staff filled in the rest of the plan and issued all the orders; then it saw that they were executed, only referring to the general for decision on matters of extreme importance. All the staff officers knew the doctrine of their general and thought along the same lines. More than this, all staff officers on all staffs were members of the same organization, the general staff, and had all been trained at the same school and in accordance with the same principles. Thus there was agreement upon all important matters throughout the entire army. The Prussian Army was the first which knew the true meaning of cooperation; the results won by this knowledge are shown by history.

Shortly before his death Moltke made a memorable statement: "Our campaign and our victories have instructed the French, who, like us, have numbers, armament and courage. Our strength will be in management, in leadership, in one word, in the General Staff. This strength France may envy us. She does not possess it." It is fortunate for the world that the French took to heart this statement in which the reason for Germany's strength was so accurately depicted by her greatest soldier. The brilliant maneuvers which culminated in the splendid victory of the Marne could not have been carried out except through the agency of the French General Staff, an organization built up during twenty-five years of peace.

II. SECOND LETTER

THE SELECTION OF THE STAFF

Having traced the historical development of the principles which should govern the operation of a staff, we are now in a position to take into consideration the principles which should govern in the selection of the officers who compose the staff.

As a preliminary step it might be well to see what qualities a general or flag officer should have and how he should be selected by the supreme command. I therefore beg your indulgence for giving you a few of my ideas on this subject. Napoleon was fond of saying: "In war men are nothing, *one man* is everything." While his idea is expressed in rather a Napoleonic—that is, exaggerated—manner, I think you will agree with it.

As one looks back on history, he can see that the greatest of leaders combined brilliant intelligence with extraordinary courage. They conceived the grandest combinations and carried them through to a successful conclusion with utter fearlessness. See how Alexander conceived his stupendous design of conquering the world with 40,000 men and did it by marching 22,000 miles in eleven years—an average of over six miles a day for this period! Look at Hannibal carrying out the grandest conception in military history, marching from Spain to Italy through an absolutely unknown country and advancing into the plains of Italy with 26,000 men against the first military nation of the world, which carried no less than 700,000 able-bodied men on its rolls!

But it is very seldom that such great brilliance and such strength of character are combined in one man. We cannot afford to wait for the arrival of such a man, for there are not more than one or two in a century. What then is the one most important quality for a general or flag officer to have? I often think of how much we lose by not taking advantage of the learning of the ancient Greeks and Romans. Perhaps you do not know that the careful historian Myers gives his opinion that the *average Athenian* possessed as wide an intellectual knowledge as the *average member of the British Parliament* to-day. The opinions of the Greeks are then of such a value that some cognizance should be taken of them. I will offer you two selections from Thucydides which bear on the subject we are now considering. The first comes from the Corinthians: "The execution of an enterprise is never

equal to the conception of it in the confident mind of its promoter: for men are safe while they are forming plans, but, when the time for action comes, then they lose their presence of mind and fail." I think Napoleon must have been looking over this statement when he said: "Any man can draw up a plan of campaign, but few are capable of making war, because only the great military genius can shape his action by events and circumstances. The best tacticians are often the worst generals."

The second selection I take from the speech of the heroic Brasidas, the greatest Spartan of his time, before a sea battle: "And whatever be your own inexperience, it is more than compensated by your superiority in valor. The skill of your enemies, which you so greatly dread, if united with courage, may be able in the moment of danger to remember and execute the lesson it has learned, but without courage no skill can do anything at all at such a time. For fear makes men forget, and *skill which cannot fight is useless*."

We must now see how nearly Napoleon's ideas coincide with those of Brasidas. You may remember that he said: "Men who do not possess much character but are highly intelligent are the least fitted for war; they are ships whose masts are out of proportion to their ballast. It is better to have a good deal of character and little intellect." Again he stated his opinion in a still more striking manner: "In France we shall never lack men of intellect or makers of plans, but we shall never have enough men of great character and vigor, in brief, *men possessing the sacred fire*." I believe every careful student of military history will confirm these opinions.

Therefore the first essential of a general or a flag officer is that he must have the "sacred fire." This must absolutely be insisted upon and every flag officer who has not this quality must be remorselessly eliminated from active commands afloat. But if the flag officer has this quality everything else may be forgiven him. Let him have vigor, resolution, energy, and courage—for thus I define the "sacred fire"—and all his commanding officers will imitate him and work will be accomplished, results will be obtained, and, if fortune gives him the opportunity, victories will be won. He can obtain intelligence from his staff, but from not even the most courageous chief-of-staff can he obtain the sacred fire. In the campaign of 1859 the Austrian commander-in-chief

lacked this quality, which his chief-of-staff had. What was the result? Alternate timidity and recklessness, depending upon the influence which the subordinate's boldness had upon the superior's weakness at any particular time.

If the leader who is selected for his sacred fire has other good qualities, it is so much the better. If he can have, in addition, a brilliant intellect he will be a military genius of the first order. If he has only mediocre intelligence, still he will be a good and successful leader. I would prefer that, if he has not great intelligence himself, that he be broad-minded and have good common sense. Thus he will know how to use the intellects of his staff officers and will recognize good ideas and logical plans when they are presented to him. To obtain this broad-minded spirit and this common sense, I consider that the course at the War College is indispensable. Certainly no one year in the life of a naval officer will so prepare him for the duties of a flag officer.

There are, of course, innumerable other qualities which it would be good for the flag officer to have, but having indicated the most important ones, I beg your permission to go on to the consideration of the selection of the chief staff officer. You notice that I do not call him chief-of-staff or senior aid, for I wish to cover the cases of all staffs, big and little. You are already beginning to guess—as I can readily see—that as we all agreed upon the flag officer having to have the sacred fire, I am now going to propose that the chief staff officer should have all the intelligence. I assure you, however, that nothing is farther from my intention. On the contrary, I insist, with the utmost vigor, that the chief staff officer must also have the sacred fire, and that this quality is far more essential for him to have than any other.

At this time you will have to consent to a short digression. I have now an opportunity for saying a few words on a subject which I consider very important. Having insisted on the flag officer and his chief staff officer having what Napoleon calls the sacred fire, you will now say that all officers without exception should have this quality; I hasten to agree with you! But is any attention ever given to the development of this essential quality? We do not hesitate to use four years in developing the intellectual power of an officer, but his moral power is left to be developed of its own accord and it is even true that there are many things

in the navy which tend to make officers timid and to kill their initiative; often a thing is left unattempted for fear of the court-martial which will kill his chances of promotion, which he may gain usually by doing merely what he is ordered and without the taking of chances. It is only by accustoming officers to run risks in peace that they will run risks in war.

We must be careful to avoid the mistakes made by the Russians, which were so clearly exposed in Kuropatkin's speech to the First Manchurian Army at the close of the Japanese War: " With us, men of independent character and initiative are rare. Search out such men, encourage them, promote them, and so encourage the growth of the qualities which are essential for all soldiers. Men of strong individuality are, with us, unfortunately passed over, instead of receiving accelerated promotion. Because they are a source of some anxiety to some officers in peace, they are repressed as being headstrong. The result is that they leave the the service, while others, who possess neither force of character nor convictions, but who are subservient and ready to agree with their superiors, are promoted."

Now how are we to encourage initiative and boldness? Experience in actual war is doubtless the best method, but such opportunities are seldom presented. The next best method, in my opinion, is flying. I therefore suggest that there be established at the Naval Academy at Annapolis a large naval air station, that flying be made a regular part of the course and that every midshipman be required to qualify as a naval aviator before being permitted to graduate. This should not require more than two months per man; the expense would be negligible when compared with the results which would be obtained; the lessons of boldness and daring learned would never be forgotten through an entire career.

You will doubtless claim that all this has nothing to do with the qualifications of a chief staff officer. However, it has a certain connection to this subject, for if every officer in the navy is inspired with this sacred fire, then the flag officer will have a certainty of selecting a suitable officer for this duty. It cannot be too often insisted that there cannot be too much sacred fire around the leader of a naval or military force. There is a saying of Napoleon which I have frequently quoted; I offer no excuse for again placing it before you: " People form a very incorrect idea of the

strength necessary to wage, with full knowledge of its consequences, one of those great battles upon which depend the fate of an army and a country, and the possession of a throne." If the chief staff officer is not himself inspired with the sacred fire how is he to sustain his leader in one of those terrible crises where even the boldest leader weakens?

As the chief staff officer will have to do the greater part of the planning and issuing of orders, it is important that he should have a good practical knowledge of the application of the principles of strategy and tactics, and have been trained in the estimating of situations, the development of strategical and tactical plans and the issuing of orders. As the course at the War College provides this training in a manner unequalled by any other similar institution in the world, it will be of evident advantage for the chief staff officer to be appointed from among its graduates. As we have claimed it essential for both flag officer and chief staff officer to have force of character, it is likewise essential, if there is to be unity of command, for both of them to be of the same opinion and in substantial agreement upon all important military principles. The importance of having officers on the same staff instructed in the same military doctrines is shown by General Von Verdi who served on the staff of Field Marshal Von Moltke in the war of 1870: "Three chiefs at the head of the sections were: Bronsart for the movement of the troops, Brandenstein for transport and commissariat affairs, and myself for everything concerning the French army. We three had been friends ever since we had been boys in the cadet school. As Bronsart, Brandenstein and myself had always kept up our friendly relations and had been in the habit of exchanging opinions on military affairs, our whole training in troop leading had been of so uniform a character as would be difficult to find in any three others. This constant service in contact as well as our private intercourse was of great advantage to us now in our new functions in the headquarters staff. One of us, for instance, might suddenly be called away from his work while writing an order to one of the armies, to receive some fresh instructions, and another would then go and finish the document which the first had begun, and yet the whole would be completed in the same spirit." At the end of a year's course at the War College, it is remarkable how unified the ideas of the class of officers become; they begin with the most divergent

theories and end in practical agreement on all substantial questions concerning strategy, tactics and leadership. The flag officer should therefore—if he has the good fortune to be a graduate of the War College—choose as his chief staff officer a member of his class there. I assure you that this is an advantage well worth striving for. It is also important for the flag officer to select an officer who is personally agreeable and devoted to him. Unless the chief staff officer has this spirit of loyalty, friction is certain to develop and the efficiency of the staff will be decreased. It is so easy for friction to develop and for little misunderstandings to occur that every precaution in advance to decrease them is well worth while.

To no person more than to a chief staff officer do the memorable words of Paul Jones apply: "He should be the soul of tact, prudence, justice, firmness, and charity." As the chief staff officer will usually be junior to a number of the officers serving under the orders of his flag officer, and as he is frequently junior to the commanding officer of the flagship, it is apparent that it is of prime importance that he be "the soul of tact." After force of character and knowledge of strategy and tactics, tact is the next important quality for the chief staff officer. You may readily imagine the number of misunderstandings which occur and the delicate situations which arise. An officer on the staff who lacks tact and has a quick temper can quickly ruin the morale of a command; when the morale is ruined, the command is ruined also.

The chief staff officer must be a man of order and system. There is much routine business in a staff and he must be capable of drawing up the most simple system for its handling. He must have a good memory and be careful and accurate, for there are a great many details which he must constantly keep in his head. He must also be an indefatigable worker, an officer who considers himself on duty at all times. He must be an officer who has had a wide range of practical experience; it is desirable that he should have had considerable experience in gunnery and engineering, for matters on these important subjects are being constantly referred to him for decision.

I am afraid that you will say that I require the chief staff officer to have every good quality, so that it will be an extremely difficult task to pick one out who will have all of these qualities.

I agree with you, for I believe that the most difficult and most important task of the flag officer is to select his chief assistant. More hinges on this decision than on any other. I refer you to the celebrated case of Ney; you know what success he gained while he had Jomini as his chief-of-staff. After Jomini left we see Ney committing error after error in rapid succession, each one seeming more colossal than the one before.

After the chief staff officer has been selected it remains to pick out the subordinate staff officers. I will not go into detail about them; it is enough to say that they should have as many as possible of the good qualities which we have seen to be essential for the chief staff officer. There is but one point I would emphasize. It is commonly supposed that aids should be socially inclined, that one of their principal duties is to be capable of gracing a reception or ball room. We do not go to war in these days in the Louis XIV fashion—unless we happen, perhaps, to be one of the decreasing number of crown princes—and I cannot take exception too decidedly to this idea. As an illustration of the point I wish to make, permit me to summon Pericles as an authority: "Maritime skill is like skill of other kinds, not a thing to be cultivated by the way or at chance times; *it is jealous of any other pursuit which distracts the mind for an instant from itself.*" The young officer can devote his time far better to the gaining of "maritime skill," and let it be "skill that can fight," than in playing the part of a social aid.

For a command on foreign station, it is essential that at least one of the staff officers be capable of acting as interpreter for French and Spanish. This is also important for a staff on home station, for there will be frequent opportunities for the student of French or Spanish to demonstrate his proficiency.

III. THIRD LETTER

THE INTERNAL WORKINGS OF THE STAFF

Once the staff is selected, it must be organized for its work. We must therefore look into the question of the organization of the staff and see its internal workings. Once this is clear, then we will be in a position to examine the real work of the flag officer—the handling and management of his command—and see how the staff assists him in this work.

The chief staff officer is, of course, responsible for the work of the entire staff. Retaining certain of the more important specific duties of the staff for himself, he should divide the other duties among the subordinate staff officers. This division of duties depends upon the nature of duty the command is performing and the number and qualifications of the staff officers available.

Hardly any two staffs are similar. It may be of interest, however, to describe the organization of one staff as a guide. I ask your permission, therefore, to give you a few details concerning the staff with which I am familiar: There are three officers on this staff; the senior acts as senior aid and has general supervision over the work of the entire staff. He reserves for himself the specific duties of drawing up strategical and tactical plans and exercises in accordance with the general instructions of the flag officer and the issuing of the orders for their execution.

All the other specific duties are divided among the other two staff officers. One of them acts as flag secretary and handles all correspondence; he has charge of all the flag office personnel; he prepares, sometimes on his own initiative and sometimes under the direction of the senior aid or flag officer, the greater part of the outgoing correspondence; he receives the incoming correspondence and answers on his own initiative the greater part of it. Important incoming correspondence is referred to the senior aid, who answers the greater part of it, referring to the flag officer only matters of really major importance. In this way the flag officer is freed from all the numerous small, but often complicated, matters which come to him for decision from the ships of his command.

The third officer is called the communication officer, but his duties cover a far wider range than this title would indicate. He has charge of all signals and despatches; he investigates all mistakes in signals and assigns each ship with the flag a standing for the weekly series of signal drills. He also has charge of communication exercises with aircraft and other experimental exercises. This officer has complete charge of all secret and confidential letters and publications in the safe, corrects all publications and keeps a careful record as to which are in effect and which are superseded, placing this information on the cover pages of the publications with the rubber stamps provided for that purpose.

He also is responsible for the handling of all courts-martial. This duty would seem to belong to the flag secretary, but as both the communication officers who have served on the staff have been reserve officers who were formerly lawyers, this duty was given to them, and with especially fine results. I merely mention this fact to show that the qualifications of the staff officers must be taken into consideration in assigning their duties. The communication officer also writes the war diary, submitting it daily to the senior aid for approval. In addition to all these duties the communication officer also acts as athletic officer.

We must now for an instant consider the enlisted personnel of the staff. It is a matter of really great importance to have a good chief flag yeoman. His duties are almost as important as one of the staff officers. It is surprising what a mass of details have to be attended to and what a number of aggravating mistakes are certain to occur, even when the most thorough precautions are taken. A careful and accurate chief yeoman will greatly decrease the number of these mistakes. He should be required to do but little work himself, but should use his time in supervising the work of the other yeomen and in eliminating their errors. He should, however, handle personally all secret correspondence, being careful to prevent it from being divulged to other personnel of the flag office. In general, the flag yeoman and printers should be men of the most reliable and trustworthy character and should be cautioned against divulging official business to other persons. Rapidity of work is important, but it should never be gained at the expense of care and accuracy. The complaint of Major Dabney, chief-of-staff to Stonewall Jackson, is an excellent illustration of these principles: "Here we had a disastrous illustration of the lack of an organized and intelligent general staff. Let my predicament serve as a specimen. As chief of Jackson's staff, I had two assistant adjutant-generals, two men of the engineer department, and two clerks. What did I have for orderlies and couriers? A detail from some cavalry company which happened to bivouac near. The men were sent to me without any reference to their local knowledge, their intelligence, or their courage; most probably they were selected by their captain for me on account of the lack of these qualities. Next to the commander-in-chief, the chief of the general staff should be the best man in the country. The brains of an army

should be in the general staff. The lowest orderlies attached to it should be the very best soldiers in the service, for education, intelligence and courage. Jackson had to find his own guide for his march from Beaver Dam Station. He had not been furnished with a map, and not a single orderly or message reached him during the entire day."

You have now seen the method by which the various specific duties of the staff are assigned to the various officers. However, it is not sufficient for each officer merely to attend to the duties to which he is assigned. There are many matters which arise which can be placed in no definite classification and which do not come under the jurisdiction of any particular officer. There are also matters which come under the jurisdiction of several of the staff officers. It is not always desirable to go through the regular procedure. The flag officer gives orders to the other staff officers without having the time to inform the senior aid; the senior aid may give instructions to the printer without first consulting the flag secretary; often it is necessary to take short cuts where immediate action and haste are necessary. This makes mistakes and misunderstandings possible unless there is the most perfect co-operation between the members of the staff; without exaggeration, the members of the staff must so work that it appears to an outsider that only one man is carrying out the entire staff business. How is this unity to be obtained—this unity without which the most brilliant staff officers will not be able to construct an efficient staff? This is a most difficult question to answer, but I will endeavor to place before you a few vague and general ideas on the subject.

First, the members of the staff must be bound together by a feeling of tact and kindliness toward each other. Second, all members must be inspired by a common love for their flag officer. Field Marshal von Moltke was able to inspire this fine spirit of loyalty in his staff officers. Every officer on a staff to-day should take to heart the wise words of Blume: "Among the staff of General von Moltke during the whole of the campaign, lasting more than six months, there was not a single jarring note. The staff formed a circle of friends, each of whom endeavored not only to do his own duty to the utmost of his ability, *but also to do his best for the others*. If this be a proof of its happy composition, the result was also largely due to the magical influence of

the great man at its head. The superiority of his master mind left no room for jealousies. His fidelity to duty, his strict adherence to fact, his modesty and unselfishness, the dignity and high-bred serenity which never left him for a moment, even in most critical situations, the kindliness which never allowed a single impatient word to cross his lips—these exemplary qualities, brilliantly brought out by successes which belong to the history of the world, had a powerful effect upon those around him. To be an assistant to such a man, in such times, was a good fortune and an honor which every one tried to make himself worthy of by thorough devotion to his duty and the suppression of all petty jealousies. It may be truly said that Moltke's mind ruled in Moltke's staff."

A third measure for obtaining this unity of action in a staff is the proper dissemination of information among the staff officers. Unless each member of the staff has ready access to all information received and unless he is familiar with the manner in which each question is being handled by other members of the staff, he will not be able to carry on his own work intelligently and orders and counter-orders are sure to ensue. One method to place all this information before the staff is to put all papers received and sent on a file board which is shown to each staff officer daily for examination and initialing. Another file board for secret and confidential papers should be used in the same way, these papers being filed in the safe by the communication officer after all have been initialed. A loose-leaf binder should be used for all signals sent and received and another should be employed for despatches. Whenever signals or despatches are sent or received, typewritten copies of them should be placed in these binders and sent to each officer for initialing. At the close of the day they should be removed from the binders and placed in the files. Should any officer of the staff be absent from the flagship temporarily, the signals and despatches should be left in the binders until his return, so that he may quickly inform himself of all important business which has been done during his absence.

This method of disseminating information should be supplemented by frequent discussions and consultations by the staff officers. For this reason it is important that the desks and staterooms of all staff officers should be close together, because the nearer these are to each other the more consultations there will be.

A subordinate staff officer having to make a decision, should, if he is not certain as to the proper procedure, consult with the senior aid. The latter should similarly consult with the flag officer on all important matters. It is much better to use a little time in consulting on a matter than to issue instructions "by direction" which have to be countermanded when the mistake is discovered by the flag officer. It also has an immeasurably better effect on the command. It is impossible for staff officers to talk over staff business too often, for it is in this way that a real staff doctrine, with which all are familiar, is developed.

But most important of all, it is necessary that staff officers should be actuated, not by ambition or personal feelings, but by devotion to their service and the most exalted patriotism to their country. Personal opinions, where they conflict with those of the flag officer, and personal animosities must be suppressed for the good of the command. Do not forget the warning of Machiavelli: "Let only one command; several minds weaken an army."

IV. FOURTH LETTER

THE ADMINISTRATION OF THE COMMAND

Now that we have gained some idea of the internal workings of the staff, we are in a position to see how the flag officer, assisted by his staff, administers his command. By this I mean the building up of the command to, and its maintenance in, an efficient condition for the discharge of its duties. When we are once familiar with the methods of administration, then we are in a position to take up our last, and by far the most interesting and important subject—the handling of the command in the execution of its duties in time of peace and war.

The administration of a command is duty which is as uninteresting as the handling of a command in the accomplishment of its tasks is interesting. It consists of the management of a great number of details, covering a wide range of subjects, all of which must be handled with promptness and accuracy.

Before an officer is capable of administering a command he must be familiar with a great mass of regulations and instructions, by which his work must be guided. Among others he must study the Navy Regulations and Instructions, the Fleet Regulations, Instructions, Standing Orders, and Circular Letters, the

Department General Orders, Bureau of Navigation publications and circular letters, Naval Courts and Boards, the Naval Digest, and his own publications and files for the last year. You will say that it is impossible for an officer to be familiar with all the fine points of all these publications, not to speak of others which would cover the whole page, were I to trouble you with them. I most certainly agree with you; if an officer were to attempt to know all the intricacies and complications of these publications, he would have time to do nothing at all for himself. However, he should endeavor to carry as many details in his head as possible and know where to find the rest in publications kept at his elbow and completely corrected to date.

Then, with the guidance of these standard instructions where they apply and with his own common sense where they do not, he must solve the innumerable problems presented to him and answer the questions which every officer of the command delights to place before him. And I assure you that it is surprising how good certain officers are in devising difficult questions. In matters concerning personnel the staff officer is required to pass on requests for change of duty, questions about the release of officers and men to inactive duty, the records of summary courts-martial; he appoints numerous courts and boards, draws up the specifications for, and appoints the members of, general courts-martial, writing the twelve letters which are necessary to convene a court of seven members. In matters concerning matériel he must pass upon requests for alterations and repairs, the assignment of upkeep periods and opportunities for coaling, surveys of Title B articles; he must place before the flag officer all the information concerning the material condition of the ships of the command so that he may decide as to the necessity for sending them to the navy yard for an extended overhaul period. He must also prepare all the reports required by higher authority and check up the reports which the vessels of the command should make to the flag. There are, as you may imagine, hundreds of other matters which must be attended to.

This doubtless sounds very discouraging, but it is not quite so bad as it sounds. There are, fortunately for the staff officer, a number of methods which he may employ to reduce the amount of work and make the necessary work as easy as possible.

As the question of administration is such a burdensome one, it is evident that each officer must carry his share of the burden. The administration of a command should be decentralized to the greatest possible extent. By this I mean that, while a certain number of very important questions must be forwarded to the flag officer for his decision, the greatest possible number should be acted on by the commanding officers of the vessels of the command without reference to the flag officer. In the same way the flag officer should refrain from interfering with the minor administrative questions of the vessels. This allows the flag officer to devote his efforts to really important matters and at the same time improves the morale and spirit of the commanding officers by showing them that the flag officer is confident that they will handle properly all matters concerning the internal administration of their vessels. The bad effect caused by the interference of the superior with the duties of the subordinate requires no proof; even in the first year of the Civil war it was apparent to our officers; General Sheridan describes this matter very accurately: "His most serious failing was an uncontrollable propensity to interfere with and direct the minor matters relating to his command, and the details for which those under him were alone responsible. Ill-judged meddling in this respect often led to differences between us, only temporary it is true, but most harassing to the subordinate, since I was compelled by the circumstances of the situation not only invariably to yield my own judgment, but many a time had to play peacemaker—smoothing down ruffled feelings that I knew had been excited by Granger's freaky and spasmodic efforts to correct personally some trifling fault which ought to have been left to a regimental or company commander to remedy."

If by this decentralization the number of questions which come to the flag officer for decision can be reduced, the questions which still must be sent to him can be attended to more easily and more efficiently if their handling can be reduced to a system. It is true that many matters arise for which there can be no system; they may never have come up before and will never be brought to the attention of the flag officer again; these must be settled on their own merits in accordance with any instructions which can be found to apply to them or according to common sense, where no instructions cover them. But the great majority of matters which

the flag officer must act upon are constantly recurring. A simple system should be devised for their handling and all staff officers and yeomen should be familiar with this system or policy, so that the decision can be made quickly and the yeomen will know exactly how to write the indorsement or letter required.

The administration of a command can be greatly simplified if instructions are properly issued to the command. These instructions should be divided into two classes: 1st. Permanent instructions; 2d. Instructions which apply to but one particular time, and which become inoperative when this time has passed. All the permanent instructions should be issued in the form of regulations. These should be printed, placed in loose-leaf binders and issued to each officer of the command. Whenever changes in the permanent instructions are made, new pages for the regulations should be printed and inserted in the place of the pages which have become obsolete. In this way all permanent instructions will be in one compact booklet, which is always corrected to date. The issuing of permanent instructions in the form of circular letters is, in my opinion, very likely to cause confusion. You issue an original letter; then you cancel several paragraphs by a second letter; you modify more paragraphs by a third letter, and finally modify these already modified paragraphs by a despatch. Who, I ask you, knows by this time what is in effect or superseded? Is it not better, when you wish to make a change, to issue the entire order, as modified, over again, take the superseded order from the loose-leaf binder and insert the new order, thus bringing everything up to date? On the other hand, instructions which are not permanent, but which apply to one particular time only should be issued in the form of circular letters. When these are complied with they can then be stowed away in the files, from which they need never be taken unless the matters to which they refer should be reopened.

I have now led up to what I consider a very important point. I warn you in advance that it is not a new one. The general principle I wish to bring to your attention is that paper work of all descriptions must be reduced to an absolute minimum. You will, I am sure, agree with me at once, and say that this is a very simple, self-evident principle, but just the same you must remember that Clausewitz said that "it is the simple which is difficult." It is all very well to say that paper work must be reduced, but still it is

very difficult to reduce it. The staff officer should hesitate every time before he issues instructions or writes a letter. Let him realize the consequences of excessive paper work.

In the first place, the more instructions he writes, the more errors there will be in them, for he will make mistakes in drawing them up and the office personnel will make more in typewriting and printing them. But the number of mistakes will not only be proportional to the amount of correspondence issued; it will be more than this; the staff officer will be in a hurry to finish his work so he can go over to the air station for a flight; the chief yeoman will be wondering whether he will be finished in time for the baseball practice; the flag officer will ask whether a certain letter has been finished. As a consequence everybody will be in such undue haste to get the business of the day through that errors will be multiplied. Each error made will cause as much time to repair as it did to write the original letter, not to speak of its other evil consequences.

Now take for a moment the position of the officer who receives the papers which you issue. You must consider the fact that he is human and liable to make mistakes too. He is sure to make some errors in reading your letters, and it is at least reasonable to suppose that the number of these errors will be proportional to the amount of the correspondence. But as the correspondence increases it will become more and more complicated, and in his haste to get through with it all the errors will be multiplied to a dangerous extent. If an officer receives a great number of instructions of an unimportant nature, which seldom directly concern him, he is very liable to skim over them without paying close atttention to them; then if something really important is issued, it is very possible that he will not notice it among the mass of unimportant details. Again, if you continually instruct your subordinate in all the small details and write them out every day, there is the chance that some day you will neglect to issue them and then he will not consider that it is necessary to carry them out that day. Listen to what Prince Hohenlohe has to say about such detailed instructions: "Again, and this is the most frequent case, it is done by general staff officers who are too deeply versed in details, who wish never to omit the least trifle, and also in no small degree to let their light shine and show that they know everything. Thus you may find that outposts are enjoined to be

alert, to send patrols and reports at the proper time. When such orders are not exceptionally necessary, this is wrong, for in most cases the order does not fit the case of each corps. But the result is—and that is the most objectional point of the matter—that the troops become accustomed to having everything specifically ordered, and they then believe themselves justified in omitting the performance of everything not so ordered. They will eventually believe that the outposts need not be alert, that the enemy is being watched by other troops, if for once alertness is not specially mentioned. Again, this or that leader does not feel himself bound to report matters unless reports are expressly required. The sending of patrols is also omitted without an express order, because on former occasions it had been specifically prescribed, but was not in this case."

I never read this passage without thinking of our captain's night order book. The idea of having a night order book for the officer of the deck is an excellent one. The times of changing course, the courses to be steered, the times lights should be sighted, their characteristics, the times for taking soundings—all these should certainly be entered in the book. But is it necessary to fill it with instructions for the officer of the deck to keep a careful lookout, to make all the required reports to the captain, to give all vessels a wide berth, and to observe the rules of the road? There are also certain instructions which should be entered in the morning order book, but is it necessary to begin with a statement as to the time of reveille and turn-to? Cannot the officer of the deck be trusted to have reveille on time without a written and signed statement every morning? Should it be necessary for the supply officer to make a formal request to the captain to keep the galley fires lighted until nine o'clock? What attention does the commanding officer pay to the report that ten o'clock lights are out, and would he ever notice it if this report was forgotten? Is it not time that we threw overboard some of these " relics of barbarism "—as one of my classmates used to call them—and get up to date on little things as well as big ones?

But we were talking of paper work and, therefore, must get back to it for just a while longer. The reports an officer makes often go to the department or the commander-in-chief. Any negligence or delay then, in your reports will be brought directly to the attention of officers high in authority. Therefore, no mat-

ter what may happen to your other duties, you may never neglect your paper work. If this is excessive a great part of your best time must be given to it, and the actual practical work with your guns or boilers must get along as best it may. As this practical work is many times more important than the writing of letters, you see that a very unsatisfactory situation arises. You find that you are in a position of the Russian officer, about whom Kuropatkin writes so bitterly: " In battle it is men he has to deal with, and not files of paper and storehouses. But situated as he is at present, he is so overburdened with important administrative details that most of his time is passed dealing with requisitions and inventories instead of flesh and blood."

Now that I have pointed out to you the many evils caused by excessive paper work you will without doubt ask me how it may be reduced. Permit me to pass a few general principles in review before you:

First, the staff officer must not write instructions about unimportant matters. In writing a letter you expend a certain amount of your own time, the time of your yeoman, and the time of the officer who reads your instructions and tries to understand them. Often letters are written on such complicated, though unimportant subjects, that they are sent from one office to another until they are covered with endorsements, each officer receiving them not being sure that he has cognizance of that matter and not having courage enough to either make a decision or throw the correspondence in the waste paper basket.

Second, when it is necessary to write about important matters limit yourself strictly to what is important and leave out other details.

Third, express what you have to say about important matters as concisely as possible.

Fourth, write so clearly that the officer whom you are addressing will understand immediately the idea you wish to convey. If your instructions are vague, he will have to ask questions and you will have to answer them. If I were not afraid of having my paper deleted I would refer you to the first general order authorizing the wearing of service chevrons as an amusing example. Above all things do not acquire that " Delphic Oracle " style; that is, of writing a letter so that it can mean two things; after the officer addressed has done one of them, you then inform him that

you meant the second; should he do the second, you have the privilege of saying that you meant the first.

Fifth, you cannot watch too carefully for careless errors in the preparation of a letter. Do not be in so much of a hurry that you sign your letters without reading them. I warn you to look even at the address, as it is easy to make a careless mistake in this—just as easy as in any other part of the letter. After you have signed a letter to a wrong address once, your examination will probably be more alert for a time.

Sixth, see that the chief yeoman checks up the addresses on the envelopes. I could give some startling figures on such unfortunate errors.

Seventh, you can do quite a little of your work orally. There should be a conference of commanding officers once a week and a great many questions can be settled there. The flag officer should encourage commanding officers to come on board the flagship and discuss with him and the staff such details as must be brought to their attention.

Eighth, call for as few reports as possible. Let ships forward direct to the department and the commander-in-chief the numerous reports prescribed. Only when they contain some data of importance should they be forwarded to the force commander. In one force the only routine reports are a roster of officers when changes occur and a ship's diary with short daily entries and a monthly statement of important defects in personnel and matériel.

I am glad to announce to you that we have now completed the discussion of the administration of the command. You may now consider it well organized and ready to carry out any operation ordered by higher authority.

V. FIFTH LETTER

THE HANDLING OF THE COMMAND

We must now consider the various methods which a flag officer may employ in the handling of his command and see how his staff assists him in this—the most important of all his duties.

As an example please imagine that a critical situation has suddenly been reported in a small foreign country and that the flag officer has been directed by higher authority to send a vessel of his command to one of its ports.

In order that the flag officer may intelligently decide upon the vessel to send he must first see what duty will be required of it. It is the duty of the chief staff officer to place before him the exact situation in the disturbed country. An estimate must be made, from an examination of past history, as to the probable nature of the disturbances. Will the conflict be between two factions of the natives or will citizens of our own or other countries be endangered? Where will the disturbances most probably take place, at a seaport or inland? Where are American citizens and where is the greater part of the American property? What action will the natives most probably take should it be necessary for a landing to be made to protect the lives and property of Americans? What forces will they bring against us? Will they be well drilled and armed?

Next, the chief staff officer should place before the flag officer information concerning each ship which is available for the duty ordered, so that he may judge as to which one will best fulfill the requirements.

First, he should determine the times at which each ship could arrive at the port designated by superior authority. The distance to the port should be determined, and, allowing for the probable state of the weather, the approximate time required to cover it at different speeds. Then the following questions for each ship available should be answered: What is the percentage of fuel on hand? Will it be necessary for her to coal before leaving or *en route?* How long will it take her to get up steam and be ready to get under way? Considering the present material condition of the engines and boilers, the efficiency of the engineering personnel, and the present condition of the ship's bottom, what sustained speed can she make good? Assuming this speed, at what time will she arrive at the port designated?

Second, the flag officer should determine the relative merits of the commanding officers of the ships available. The chief staff officer should have answers for the following questions: Is the commanding officer familiar with international law? Will he probably cooperate on friendly terms with the American consular and diplomatic agents in the country to which he is ordered? Will he act tactfully toward the natives? Will he sympathize with the natives or with the American citizens in

the country? Will he act on his own initiative without instructions from higher authority should there be necessity for such action? If fighting should take place, has he the necessary force of character to bring it to a successful conclusion?

Third, the flag officer must decide as to the relative fighting strengths of the ships available. What is the draft of the ship? How close in to the shore can she anchor? What is her battery? What time has elapsed since she last held target practice? How many men has she in the landing force? Is it well trained? How long since it has fired on the rifle range? How many machine guns are available?

Fourth, a decision must be made as to the relative ability of the ships to maintain themselves in the port to which the ship must be ordered. Will the draft of the ship permit her to anchor in a sheltered berth? How many days can she remain in the port without having to replenish her fuel supply? Is the fuel used coal or oil? Can proper fuel be obtained in the port or at another port close at hand? When did the ship complete the last overhaul period in a navy yard? How much longer can she be maintained without another overhaul period? What are the facilities of the engineer department for making repairs? How many days' provisions can the ship carry? How many days' supply will be on hand at the time the ship leaves? Can the fresh water supply be maintained indefinitely without obtaining water from the shore? Is the cold storage in good condition? Is the ship screened from mosquitoes?

The chief staff officer, after supplying all this information to the flag officer, should give his opinion as to the proper decision. The flag officer should then inform the chief staff officer of his decision and give him orally a general outline of the movement order to be written. The chief staff officer should then have a rough copy of the order typewritten under his direction and should submit it to the flag officer for his approval. When approved by the flag officer the proper number of copies should be carefully typewritten. Every word of it should then be carefully checked by the chief staff officer. The mistake of one figure in a latitude or date may ruin an entire operation; such mistakes are certain to occur sooner or later unless every precaution is taken; the figures in the order should be compared with the original data, worked up by the chief staff officer.

After he is certain that the order is correctly written he should present it to the flag officer for signature and then send the original copy to the ship selected for the duty.

If immediately after the flag officer has made his decision, a signal is made for the ship to get up steam, there will usually be sufficient time to write the order in this way and deliver it to the ship before she is under way. However, if there is some special reason for haste, the making of the rough copy may be eliminated and the smooth copy can be made first. The most satisfactory method in this case is for the chief staff officer to write the smooth copy of the order immediately on his own typewriter; this can be done easily in ten minutes; five minutes more should be allowed for the delivery of the letter by a fast boat; thus you see that the order should be delivered in about fifteen minutes.

You are doubtless surprised by this celerity of staff work. You perhaps think that the chief staff officer must be an expert on the typewriter to write an order several pages long in the short space of ten minutes. But of course the secret is that the order is only two paragraphs long, and there are not over four lines in each paragraph. Permit me to give you an example of such an order:

AMERICAN PATROL DETACHMENT,
DOLPHIN, FLAGSHIP,
KEY WEST, FLORIDA,
19 March, 1920, 2.35 p. m.

Movement Order
No. 52

FORCES

RALEIGH, Captain ....

1. Situation in HAITI is critical. Rioting has occurred in PORT-AU-PRINCE. AMERICAN lives and property endangered throughout HAITI. EAGLE is at CAPE HAITIEN. DUBUQUE is due to arrive PORT-AU-PRINCE twenty-two March.
2. RALEIGH proceed immediately to PORT-AU-PRINCE, assume command of all Naval Forces in HAITI and protect AMERICAN interests.

Signed ....
Rear Admiral
Commanding American Patrol Detachment

Copy by boat to:
RALEIGH

Copies by mail and despatch to:
Operations
Commander-in-chief
EAGLE
DUBUQUE
Naval Station, GUANTANAMO

You will note that this form follows the usual form for campaign orders as far as this applies to the order to a single ship. A standard approved form should, of course, always be used, for this increases the readiness with which orders can be written and understood.

In the first paragraph is given all the information of the situation and of other vessels with which the officer to whom the order is addressed may have to deal. In any written communication it is always proper to begin with a statement of the situation so that the person addressed will have all the facts clearly placed before him before considering the order, suggestion or recommendation which is contained in the second and succeeding paragraphs of the communication. I would carry this system so far as to make it apply to all despatches, signals, letters and other communications as well as movement and campaign orders. You doubtless know that in writing a letter it is often hard to get started. If you begin with a statement of the situation with which you are thoroughly familiar the rest of the letter can be written easily.

In a movement order it will be found advisable to place all the instructions in the second paragraph. Two paragraphs are not necessary for the instructions to a single ship and the fourth and fifth paragraphs of the campaign order form are seldom necessary, and when necessary can be placed in the first paragraph as coming under the head of information. You will notice that the instructions are very simply and concisely stated. Perhaps you think they are vague and that the phrase "protect American interests" is indefinite. However, they would not seem vague if you could see the detachment doctrine. This prescribes clearly and precisely the various methods which should be used in accomplishing this mission. Not only the commanding officer is familiar with the doctrine, but every officer on his ship thoroughly understands it. Furthermore this question has been frequently discussed in many conferences of the commanding officers at which the flag officer has set forth his ideas on such operations. Also the methods used in similar situations in the past is described in the detachment diary, which is printed and issued to all ships for the purpose of indoctrinating the officers and building up a detachment spirit.

Again it would be very undesirable for the flag officer to issue detailed instructions to cover this special situation. In the first place no officer can be thoroughly familiar with what is happening at a place over 500 miles away. Even the most voluminous despatches could not permit him to have an intimate knowledge of a rapidly changing situation. In addition to all this consider that it will take the ship two days to reach its destination. Certainly you cannot expect the flag officer to predict what will happen during this period in advance. Moltke tried to predict for three days in advance when the third army and the army of the Meuse were advancing toward Chalons in 1870, but he had to issue a counterorder during the third day because the French made a move which nobody at the time would have considered possible.

You know of many instances where officers on detached duty were held down to detailed hard and fast orders. It is the principal lesson you will learn in reading the campaigns of Frederick the Great. Even as marvelous a leader as Frederick was could not get altogether out of the old way of doing business. Absolute and strict obedience of orders to the letter was what he required. You may see this idea in his enthusiastic praise of Moritz of Dessau after the battle of Leuthen, "You have helped me, and performed every order, as none ever did before in any battle." Again you may notice it in his cruel rebuke to the old Dessauer: "I am greatly surprised that your Serenity, as an old officer, does not more accurately follow my orders that I give you. If you were skillfuller than Cæsar and did not with strict accuracy observe my orders, all else would be of no help to me. I hope this notice, once for all, will be enough; and that in time coming you will give no further causes to complain."

You will see the effect of these ideas all through Frederick's campaigns. When he could oversee every detail all went well. When he gave one of his generals an entirely independent command in a distant sector he almost invariably did splendidly. But when he tried to issue any instructions to a force at some distance or to get two separate forces to cooperate under his orders the results were often unsatisfactory. Thus he pushed Finck into an awkward position at Maxen to cut off the retreat of the Austrian army; but Finck, although the next best officer to Frederick in the entire army and although he had such splendid

officers as Wunsch, Wolfersdorf and Mosel as subordinates, had never been trained in such operations. As a general acting independently he had an excellent record and he knew how to lead a division under the direct orders of the king, but in such a case as this he had no idea as to what to do. Instead of following the spirit of his orders, which indeed were liberal enough, he followed them strictly to the letter and his entire force was destroyed by overwhelming numbers. Very truly does Carlyle say: "If Frederick could have made himself into two; and, while flashing and charging in Daun's front, have been in command at Maxen in Daun's rear—Frederick could have made a pretty thing of this Maxen enterprise. But there is no getting two Fredericks. Finck, a general of approved quality, is the nearest approach we can make to a second Frederick and he proves tragically inadequate." But it was only Frederick's unreasonable system which made his ablest assistant "tragically inadequate."

Again in 1760 General Fouquet, a most magnificent officer, was being driven back somewhat before the three-fold numbers of the Austrians. Frederick, angered by the loss of Landshut, gave him peremptory orders to retake it. "Deeply hurt, he read this order; and vowing to obey it, and nothing but it, used these words, which were remembered afterwards, to his assembled generals: 'Meine Herren, it appears, then, that we must take Landshut again. Loudon, as the next thing, will come on us there with his mass of force; and we must then, like Prussians, hold out as long as possible; think of no surrender on open field, but if beaten defend ourselves to the last man. In case of a retreat, I will be the last that leaves the field; and should I have the misfortune to survive such a day, I give you my word of honor never to draw a Prussian sword more.'" Landshut was retaken by Fouquet with his 13,000 men, but the sixth day afterward Loudon came down with 31,000 and poor Fouquet never drew sword again.

Napoleon, in many ways, improved upon Frederick's system. In a great many cases he allowed great initiative to his subordinates. But how many times do we hear him say that no one knew his system. The reason for this is well shown by a little note from Berthier to Ney in the Eylau campaign: "The emperor, marshal, has in forming his plans, no need either of

advice, or of anyone acting on his own responsibility. No one knows his thoughts; it is our duty to obey."

I claim for our own country the honor of being the first to use in actual warfare the new system of command. The Confederates were the first to allow the subordinate a reasonable latitude in the selection of the methods to be used in the execution of a plan, while at the same time they insisted on a most loyal obedience to the spirit of this plan. At the beginning of the Peninsula campaign Lee wrote to Jackson: "The blow, wherever struck, must, to be successful, be sudden and heavy. The troops must be efficient and light. I cannot pretend at this distance to direct operations depending on circumstances unknown to me, and requiring the exercise of discretion and judgment as to time and execution."

Henderson says of Jackson: "He was not one of those suspicious commanders who believe that no subordinate can act intelligently. If he demanded the strictest compliance with his instructions, he was always content to leave their execution to the judgment of his generals; and with supreme confidence in his own capacity, he was still sensible that his juniors in rank might be just as able. His supervision was constant; but his interference rare; and it was not till some palpable mistake had been committed that he assumed direct control of divisions or brigades."

It is true that these principles were not grasped by the commanders of the Army of the Potomac for several years. Even as late as the Battle of the Wilderness in 1864 General Meade held to the old system. Let Sheridan tell how it worked: "A little before noon General Meade sent for me, and when I reached his headquarters I found that his peppery temper had got the better of his good judgment, he showing a disposition to be unjust, laying blame here and there for the blunders that had been committed. He was particularly severe on the cavalry, saying, among other things, that it had impeded the march of the Fifth Corps by occupying the Spottsylvania road. I replied that if this were true, he himself had ordered it there without my knowledge. I also told him that he had broken up my combinations, exposed Wilson's division to disaster, and kept Gregg unnecessarily idle, and, further, that such disjointed operations as he had been requiring of the cavalry for the last four days

would render the corps inefficient and useless before long. Meade was very much irritated, and I was none the less so. One word brought on another, until, finally, I told him that I could whip Stuart if he (Meade) would only let me, but since he insisted on giving the cavalry directions without consulting or even notifying me, he could thenceforth command the cavalry corps himself—that I would not give it another order. The acrimonious interview ended with this remark, and after I left him he went to General Grant's headquarters and repeated the conversation to him, mentioning that I had said that I could whip Stuart. At this General Grant remarked: '*Did he say so? Then let him go out and do it!*'" Sheridan did it!

But I see that my fondness for history has induced me to go somewhat deeply into my subject. To tell the truth I had an ulterior object in giving you this information about our Civil War generals. The Germans are usually credited with introducing the modern system of command. Perhaps they were the first to use it as a set policy, but you can see that they had the example of the four greatest generals of the Civil War to follow: Lee, Jackson, Grant and Sheridan.

But if the issuing of detailed orders has a bad material effect, it has also a very evil moral effect which is even more important. Fancy poor General Loudon, who, after storming Schweidnitz in a brilliant enterprise and taking 3000 prisoners, 211 heavy guns and 135 mortars, was nearly dismissed from his command for disobedience of orders, he not having informed the Empress and War Council at Vienna of his plan in advance. On the other hand picture happy Sheridan and his splendid cavalry corps starting out after Grant's inspiring command: "Then let him go out and do it." To carry out an operation after all the plans have been arranged for you is not nearly as interesting as though you are allowed by a chief, who will give you his utmost support, to make your own plans and carry them out without interference.

When an order can be typewritten and delivered by boat the time taken to draw up the order and transmit it is very small. In this case it would not take very long to write a whole page or even two. However, when it is necessary to send the order by despatch, the length of the order has a very important effect upon the time taken for its transmission. It requires no proof to show that an order which must be written, coded, enciphered,

sent by radio, relayed by land wire, sent again by a shore radio station, received by a ship, deciphered, decoded and written out will be greatly delayed in transmission if it is lengthy and complicated. Coding and ciphering are duties which require great concentration of thought and in which one must be on the constant lookout for mistakes. They are not popular duties and often must be carried out under adverse and uncomfortable conditions. Often the coding officer will be wakened in the middle of the night; at such a time a whole page of matter to code or decode is not a pleasing sight; if the ship is running without lights, the room where the coding must be done is usually hot and stuffy; a heavy sea often does its part in adding to the pleasures of the occasion. Coding and enciphering is tiring work and after working at full speed for an hour it is surprisingly easy to make mistakes, even though you go slower and slower and try to become more and more careful. The coding officer is not nearly so liable to make mistakes in the case of three short messages sent at different times, as in the case of one long message, having a number of words equal to the first three combined, which must be coded without an intermission. The same applies to the transmitting of the despatch by radio; this is also a duty which requires intense mental concentration, and when an operator gets near the end of a long message his alertness decreases and garbled words are the result. For all these reasons a long message will be delayed in transmission. Furthermore some parts of it may be so badly garbled that no sense can be made of it at all and the entire message must then be repeated. However, should it ever be necessary for some special reason to send a lengthy order by despatch, it will be well to send the important part of it—such as the order to proceed—in a short despatch, following this with a longer message—which can be received after the ship is under way—giving the detailed orders.

The staff must take care that none of their confidential papers and orders get adrift, are seen by unauthorized persons, or that their contents are divulged by officers or men of the staff in too free conversation with outsiders. In the Antietam campaign the Federals picked up a copy of Lee's recently issued campaign order in Frederick. This had very disastrous results as it placed Lee's entire plan in the hands of McClellan. Ar-

rangements must also be taken to see that orders are not lost in transmission. In the Eylau campaign the Russians captured an orderly on whom was found Napoleon's orders to Bernadotte. This allowed them to escape the trap laid for them by the master and also left Bernadotte without orders, so that he did not arrive in time for the battle.

It is more difficult to write an order, despatch or signal, so that it can be immediately understood by everybody, than you would believe. An officer who can write a clear order ought immediately to be ordered to staff duty for this reason alone. You may have heard the interesting story of General Grant's aid; he was an old major who had a reputation for being particularly dull and stupid; everybody wondered the reason for his being on such a competent staff; finally one officer asked the reason; the general replied that every order before being issued was shown to this officer; if the major could understand it, it was assumed that it was perfectly written and that any other officer in the entire army could. I am compelled to doubt the accuracy of this story, but it illustrates the suggestion I wish to make. Every officer of the staff who writes an important communication of any kind should submit it to another staff officer and ask his opinion as to whether it is clear or not. If there is any doubt in the mind of the second staff officer, it should be rewritten. One of the most extraordinary orders ever issued was the one sent out by Lee's staff before the attack on Malvern Hill. It read as follows: "Batteries have been established to rake the enemy's line. If it is broken, as is probable, Armistead, who can witness the effect of the fire, has been ordered to charge with a yell. Do the same." This order was sent only to D. H. Hill and Magruder and then countermanded before being sent to the other divisions. Soon after it was received by General Hill the Federal skirmishers attacked Armistead, and Hill, taking this as the signal for the attack to begin, moved out alone with 10,000 men against the entire Federal army, meeting of course with a costly repulse.

Whenever an order is issued it is important that copies of it should be sent to all other officers who may be interested in the operation. It is very important that every officer who is in any way concerned should have all the information possible of our own and the enemy forces. In the campaign of Waterloo alone

I could show you ten cases where the most important information was not forwarded. For instance, General Reille did not inform his commander, Ney, that the Prussians were seen on the right forming for battle near Ligny. Later in the day Erlon's Corps appeared in the left rear of Napoleon's forces; as Erlon had sent no aid in advance telling of his approach, Napoleon thought they were enemy forces and delayed the attack of the Guard for two hours, a delay which prevented him from crushing utterly the Prussians at Ligny. But the most remarkable errors were made after the conclusion of the simultaneous battles of Ligny and Quatre Bras. Wellington did not hear that Blucher was defeated until 10 a. m. the next day; Napoleon did not inform Ney of the result of the battle of Ligny until 8 a. m.; and Ney did not report the result of the battle of Quatre Bras until noon. The French threw away at that time wonderful opportunities which would have decided the campaign.

You possibly think that I lay too much stress on the issuing of what you may call purely formal orders. Possibly you think that instead of writing an order it is sufficient merely to send an aid over with the necessary instructions. Jackson tried this once at the battle of Gaines Mill. You may be assured that the results were anything but satisfactory. Then you may call the officer, to whom you wish to issue the orders, to a conference, but even this is a poor procedure unless written orders are given to him also. Ney and Napoleon talked over their plans nearly all the night of the 15th of June, but so indefinite an idea did Ney get of the duties required of him that, although he was supposed to move at 6 a. m., he did not start until noon of the next day, when he received peremptory orders to do so. Napoleon gave Grouchy only oral orders to follow the Prussians and poor Grouchy, who was the last officer in the world to whom 33,000 men and an important independent command should have been given, had not the slightest idea as to what to do, nor could he obtain any more information or other orders until it was too late. He had heard the emperor reprimand Ney for not following his orders "pure and simple" and so he was content to follow the Prussians as ordered. You know what the results were.

Once a decision is made and the orders issued, they must not be changed except for the most important reasons. Immediately

after you send out an order you begin to be assailed by doubts, to wonder whether it can be carried out, to imagine all sorts of difficulties. In such a situation remember the words of Frederick to his brother: "I have seen with pain that you represent everything to yourself on the black side. I beg you in the name of God, my dearest brother, don't take things in their blackest and worst shape—it is that which throws your mind into such an indecision, which is so lamentable. *Adopt a resolution rather, what resolution you like, but stand by it, and execute it with your whole strength.*" This seems a very simple axiom and the easiest thing in the world to do. You perhaps wonder that I even mention a matter which is so self-evident. But, in my opinion, to arrive at a clear, definite decision and to carry it through unchanged is the most difficult task in the entire art of command. In how many beaten armies do you see the confusion caused by the indecision of the commander? The Prussians in 1805, the Austrians in 1859, McClellan's army in 1862, Pope's in 1863 and the French in 1870 were defeated by the indecision of their leaders even before a battle was fought. It is true that these armies were led by mediocre commanders, but how many great leaders are there who have not shown this fault at some time during their campaigns? See Cæsar at Thapsus hesitate to give the word to advance until the legionaries themselves spontaneously burst forth! Frederick gives way to despair after the terrible defeat of Zorndorf. Massena hesitates until too late before the lines of Torres Vedras. Napoleon allows Bessières to persuade him not to use the Guard at Borodino. Look at Wolfe at Quebec: "Within the space of five hours we received at the General's request three different orders of consequence which were contradicted immediately after their reception, to the no small amazement of everyone." See Nelson worrying himself literally to death over the escape of the French fleet. All these officers were specially noted for their strong character and resolution, and if such men as they sometimes showed indecision it is certainly something against which every precaution should be taken. The best precaution is to have a staff of strong officers who are absolutely loyal to their chief; they should assist him to come to a clear and definite decision, and when once made "to stand by it and execute it with your whole strength." The chief staff officer, especially, should be the most optimistic person in the

world; should he see the flag officer, bending under the weight of his responsibility, begin to have misgivings as to his own plan, he must argue with all his might that the original order was correct, that the difficulties in the way of its execution are exaggerated and that counter orders should not be issued. He must recall the words of Napoleon: "But when I have come to a resolution everything is forgotten, except that which will lead to its attainment." A staff officer who criticises an order after it has been issued without the strongest reasons should be dismissed from his post. A staff composed of such officers will soon ruin any command.

A flag officer is frequently required to cooperate in the execution of a task with officers of his own service, with the army and with allied forces. In order that this cooperation may be effective it is necessary that a kindly and friendly spirit exist between his staff and the staff of the other officer, as most of the business will be carried on through the agency of staff officers. If the staff officers conduct the negotiations tactfully many delicate questions can be smoothed over and the business so arranged that it will be to the advantage of both commands. Blucher's cooperation with Wellington at Waterloo is probably the best example of one army coming to the assistance of another in the very nick of time. Only one day after the Prussians had been badly defeated at Ligny and while their commander was still on a sick-bed as the result of being ridden down in a cavalry charge, he received word from Wellington that the British would give battle to Napoleon the next day at Waterloo provided they could count on having the assistance of two Prussian corps. Blucher replied: "I shall not come with two army corps only, but with my whole army; under this understanding, however, that should the French not attack us on the 18th, we shall attack them on the 19th."

We have now come to the end of these letters. Let me pass in review some of the most important points.

First, a flag officer afloat must be selected for his force of character, courage and resolution.

Second, he should select as his chief staff officer a man of great force of character, who has a practical knowledge of strategy and tactics, administrative ability and who is in substantial agreement with him on all important professional subjects.

Third, the flag officer and the chief staff officer should select the rest of the staff, choosing officers of known ability who have the same characteristics as are necessary for the chief staff officer.

Fourth, the administration of the command should be delegated as far as possible to the commanding officers.

Fifth, administrative details which must be passed upon by the flag should be handled quickly, accurately and carefully by the staff. Only the most important matters should be referred to the flag officer for his personal action.

Sixth, when the command is to be used for the carrying out of important duties or operations, the situation must be carefully and completely estimated by the chief staff officer; the flag officer should himself make the decision, considering, however, the opinions of the other staff officers.

Seventh, the decision once made, clear and concise orders should be quickly delivered to the selected vessels, every precaution being taken to prevent their contents from being divulged; the orders should state only the task to be accomplished, the methods to be used in its accomplishment being left to the initiative of the officers on the spot, guided by the force doctrine.

Eighth, the orders once issued, the flag officer must stand by his decision with all his force and should not issue counter orders except for the most important reasons.

Ninth, the flag officer must cooperate in the most friendly spirit with other officers of the navy, of the army or of foreign services allied to his.

It may have occurred to you that through the entire length of this paper I have been trying to prove to you the advantages of the offensive spirit, the fighting spirit that has always been alive in our navy, and, with God's help, always will be. But we must always remember that we must always keep on building up this spirit. We have already enough skill, but we want skill that can fight, we want the sacred fire. Please take for your motto the noble words of Brasidas as he entered into his last battle: "I will show you that I can not only advise others, but fight myself."

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN EASY METHOD OF GETTING THE GREENWICH MEAN TIME

By Lieut. Comdr. Franklin Van Valkenburgh, U. S. Navy

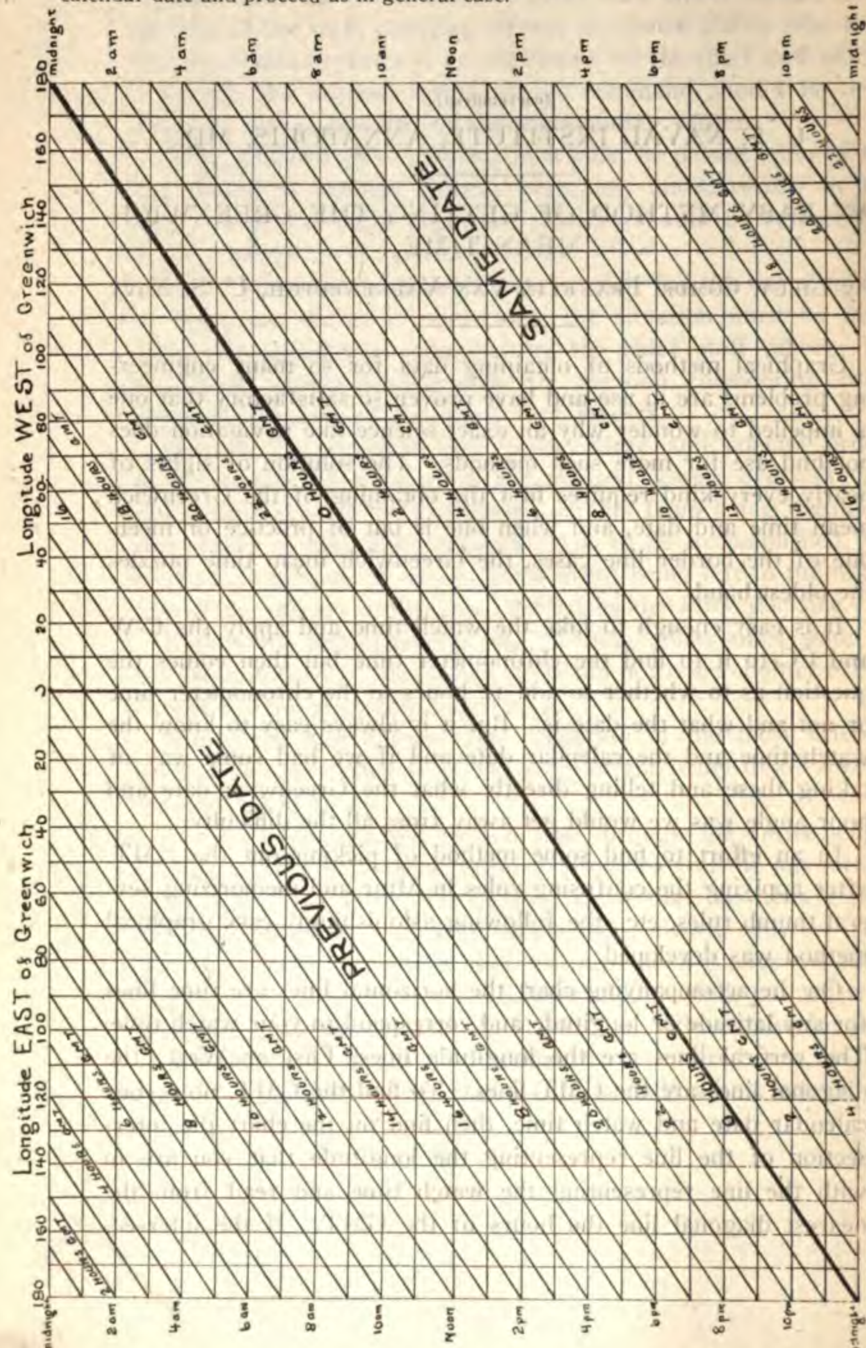
Graphical methods of obtaining data for so many engineering problems are in use and have proven so satisfactory that one is impelled to wonder why an exact science like navigation does not find use for more such methods. The solution of sights of nearly every kind requires first the obtaining of the Greenwich mean time and date, and when one is out of practice or meets one of the border line cases, the Greenwich mean time puzzles the oldest hand.

It is easy enough to take the watch time and apply the C-W and CC to it to find the chronometer time but then comes the question as to whether to add 12 hours to the chronometer time or not and what the date is. But it is always easy to know the watch time and the calendar date and if we had some way of taking these and telling directly what the Greenwich date and hour angle was we would get away from all the difficulty.

In an effort to find some method of picking out the GMT, after applying the confusing rules in Muir and memorizing several thumb rules, etc., the following astonishingly easy graphical method was developed.

On the accompanying chart the horizontal lines are time lines for any latitude or longitude and correspond to your watch time. The vertical lines are the longitude lines, East or West; the diagonal lines are the GMT lines. To find the GMT, note your calendar date and watch time, then find on the chart the intersection of the line representing the longitude that you are in with the line representing the watch time and read from the nearest diagonal line the hours of the GMT. If the intersec-

In crossing the 180th meridian from west to east longitude add one to the calendar date and proceed as in general case.



To find the GMT corresponding to any civil time, first set down the calendar date, then enter the curve at your longitude line (east or west) following this line until it intersects the time line (horizontal line) corresponding to

In crossing the 180th meridian from east longitude to west longitude sub*tract one from* calendar date and proceed as in general cases.

tion lies below the zero hour line the GMT date is the same as your calendar date; if the intersection lies above the zero hour line the date is one day preceding your calendar date.

In crossing the 180th meridian from west longitude to east longitude add one to your calendar date and proceed as in the general case. In crossing from east longitude to west longitude subtract one from your calendar date and proceed as in the general case.

The principle on which the chart is constructed is the very simple one of drawing in the lines representing the loci of all places having the same GMT at the same time.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE NAVY'S FIRST AIRSHIPS

By COMMANDER J. C. HUNSAKER, Construction Corps, U. S. Navy

During the summer of 1916, German submarine activities made it very clear that the pre-war methods of coping with such craft were astonishingly ineffective. It did not then appear that the United States would become involved in the war, but the possibility began to be discussed, and special attention was naturally paid to the technical problem presented by anti-submarine warfare. Due to the strict secrecy, shrouding the anti-submarine operations of the Allies, only very vague accounts of the weapons used were available. It did appear, however, that it was necessary, as in the receipt for rabbit pie, first to catch your submarine. This seemed to be a problem of intensive patrol of coastal waters and the approaches to maritime ports. We knew of the conversion of trawlers, yachts and miscellaneous small craft for this purpose and, of course, were aware of the British contracts placed in the United States for motor boats and flying boats.

In addition to such craft, rather fragmentary accounts began to appear in the press, or were brought back by returning travellers, which indicated that the British were experimenting with small airships or dirigibles for coastal patrol work. This intelligence was not at all definite and entirely non-technical.

The possible need for dirigibles by our own navy happened to be under consideration at that time. The department, in May, 1915, had contracted for one dirigible with a firm which had got hold of a German engineer, a German mechanic and an Austrian dirigible pilot, supposed to be experts. This first dirigible designed and built under the supervision of the imported talent was a great disappointment, for when it was completed, two years later, April, 1917, it was so much over weight

that it could barely lift itself off the ground. It was entirely without military value and was further worthless as a training ship, an account of its complicated and unreliable power plant installation. It did, however actually fly and since the firm had built the ship in good faith and at a cost greatly in excess of the contract price, it was formally accepted and designated *A-1*. After a few short flights it was put back in its shed, deflated, and eventually broken up.

This experience was naturally most discouraging, especially as little or nothing was learned which would serve to insure a

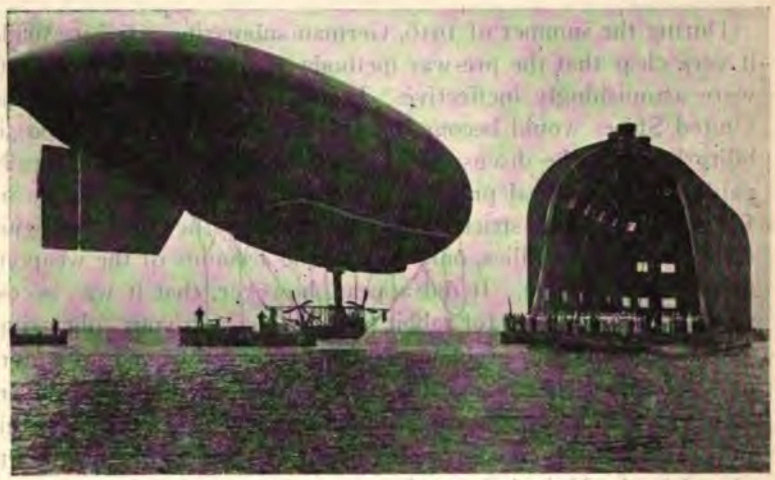


FIG. 1.—Airship *A-1* returning to floating hangar after trial flight at Pensacola. Two propellers are driven through gearing by a single 140 B. H. P. engine. In the B class all gearing was eliminated.

satisfactory design if another attempt were made. The prospects for developing airships for the navy were very poor. Aside from the concern which built the *A-1*, the Connecticut Aircraft Company, there were in the country no firms with any experience in modern airship construction.

However, intimations of the success obtained abroad with dirigibles could not be ignored, and as the failure to provide dirigibles if called for by the Department would rest with the Bureau of Construction and Repair, it was necessary to anticipate such a call and to learn the new art. For this there was no teacher.

In any branch of engineering, when one passes beyond the limits of practical experience, one must depend on theory; and where an adequate theory has not been developed one must deduce a convenient one. The theory of free ballooning was well established and the literature of the art extends back a hundred years, but the theory of airship design is not at all complete, as the bulk of the work before the war had been done by the French and German armies and was naturally kept secret. However, we had the manuscript of Prof. Marchi's lectures at the University of Paris on airships and balloons, Basenach's book "Prall Luftschiffe," Haas und Dietzius on "Stoffdehnungen und Formänderungen der Hülle von Prall Luftschiffe," Eberhardt on "Theorie und Berechnung von Motorluftschiffen," and a few papers in the technical press or presented before scientific societies. When all of the available literature was assembled it made an imposing pile, but a careful threshing revealed very little that was definite enough to be useful. The theory was, however, sufficiently complete in a general way except for a void with regard to the stability and control in flight. For knowledge of practice and details of construction, we were a little better off though wholly without experience. An investigation of dirigible construction in England, France and Germany had been made in 1913 and a good deal of information obtained, in spite of the normal European military restrictions. However, such information applied to dirigibles of 1913 and we were well aware that we were in 1916, and it was evident that the British had developed an entirely new type.

In order to be prepared for the future, various theoretical and experimental studies were undertaken by the bureau in the summer of 1916. A need for training officers in operating airships was felt by the office of the chief of naval operations, which in October, 1916, asked the bureau to prepare studies for a training airship to carry six men and to have an endurance of 4 hours at 40 miles per hour. Some work was done on this problem, but was abandoned on receipt of later requirements from that office for an airship to be used both for training and coast patrol. These later requirements were received on December 13, 1916, and specified a maximum speed of 45 miles, endurance of 12 hours at 35 miles, a crew of 3 men, with radio for 150 miles,

and provision for alighting on the surface of the sea and for towing from a vessel.

These military requirements were carefully compared with information available as to foreign construction and with an independent analysis of the coast patrol problem.

From British accounts a small airship was useful. We knew they used a 75- or 80-horsepower motor, but did not know the speed, endurance or load. It was clear, however, that for patrol work the endurance should be enough to permit daylight patrols of 10 or 12 hours duration. At night, a patrol airship would be relatively useless and hence such an endurance seemed great enough.

The speed must be sufficient to enable the airship to get back to her base against a head wind. As our ships would operate off the Atlantic coast and as the prevailing winds are westerly, it was necessary to provide a safe margin of speed. It was believed that a wind of 30 miles per hour was the limit for handling the dirigible in and out of her shed and, therefore, she would not operate on days with greater wind. This would permit operating in all fair weather. To provide for a margin to get home, an excess speed of 15 miles was considered reasonable, giving an air speed or speed in still air of 45 miles.

The size of the ship determines the total displacement or lift. The English experience seemed to point to the smallest size consistent with other qualities and in our ignorance and inexperience it seemed very desirable to attempt the smallest size of ship that promised to be useful. It also had to be remembered that there were no qualified pilots available and our first pilots would have to teach themselves to fly. A small ship appeared especially desirable for training.

The only engines in the country with any claim to reliability were at this time the Curtiss 8-cylinder 100-horsepower, and the Hall-Scott 4-cylinder 100-horsepower aeroplane engines. These engines were of the high revolution type not especially suitable for airship work, but there were no others. Twin engines would give greater reliability than one, but would require a larger ship. A decision was made to try to use but one engine in order to keep down the size of the ship.

Having fixed the above characteristics, it remained to fix the load to be carried; fuel and oil for ten or twelve hours, three

men (the crew), radio, a blower to keep up pressure of air in ballonets, an allowance for ballast and bombs, and a margin for unforeseen equipment and contingencies.

The necessary lift required an envelope of about 77,000 cubic feet, which with ordinarily good hydrogen gas gives a total lift or buoyancy of 5275 pounds.

The envelope was then designed to give this lift and made of a shape which should be easy to drive. Experiments were conducted at the wind tunnel at the Washington Navy Yard to determine the resistance of this shape in order that the speed could be computed. It appeared possible to obtain the desired speed of 45 miles, but without any margin to spare.

We had heard that the British dirigibles were fast, but aside from them there was no record of a dirigible of such small size ever having been driven at a speed so high as 45 miles. Unless the fin and rudder surfaces were correctly proportioned, there would be difficulty in steering the ship at high speed. A research in the wind tunnel was, therefore, undertaken with a model of the ship fitted with fins and rudders of various sizes and arrangements. From these experiments fins and rudders were designed which appeared to be on the safe side and to guarantee stability in flight. (These surfaces were found on the trials to be satisfactory and, subsequently, it was possible to reduce them in area when our pilots became more expert.)

The car to carry the engine, fuel tanks, pilots and other weights was designed after aeroplane practice, and presented no difficulties, except balance. The fuel tanks might be in flight full or nearly empty and to avoid disturbing the trim of the ship the tanks must be under the center of buoyancy of the envelope. The weight of fins and rudders tends to make the ship trim by the stern and to balance this, the fixed weights, engine, men, radio, blower, etc., should be placed forward of the center of buoyancy a sufficient distance. To provide for proper balance the car was designed to have the tanks in the rear end under the center of buoyancy of the envelope and the engine forward with the men and other weights between. This gave a long car resembling the fuselage of an aeroplane and distributed the weights correctly.

The next problem was the suspension of this car from the gas bag, or envelope, in such a manner as not to deform the bag or put undue tension on any part of its fabric. The envelope was merely a fabric gas bag held taut by internal gas pressure and the greatest delicacy and skill were required in suspending the car. The calculations involved in the design of the suspension had to be devised from general engineering principles, but were not very satisfactory on account of the indeterminate nature of the distribution of load between various suspension members. It was desired to use the lightest fabric for the envelope that could be considered safe and to this the suspension was to be attached so that the enevelope would be held fair and stiff

FIG. 2.—Airship *A-1* in flight. The outriggers on bow and stern of car were used to help distribute the weight along the envelope. In the B class, this was unnecessary.

with no more than one inch of water pressure inside. The calculation made was an application of the naval architect's usual method for calculating the longitudinal strength of ships and appears to be justified by the results.

To verify the calculated strength of the envelope fabric and the internal pressure necessary to preserve a fair form under the influence of the suspension loads and the forces expected on fins and rudders, a water-model experiment was made. This form of test was described by Haas and Dietzius, who give credit to Crocco, and proved to be extremely useful. So complete a method of verification by model experiment with the actual materials to be used, is, I believe, unique in practical engineering work.

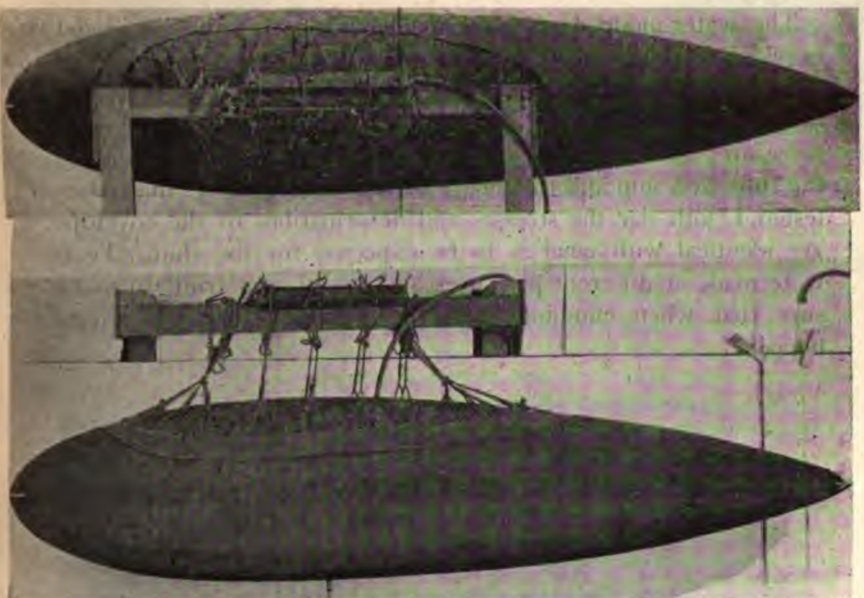


FIG. 3.—Fabric model of B class envelope filled with air.

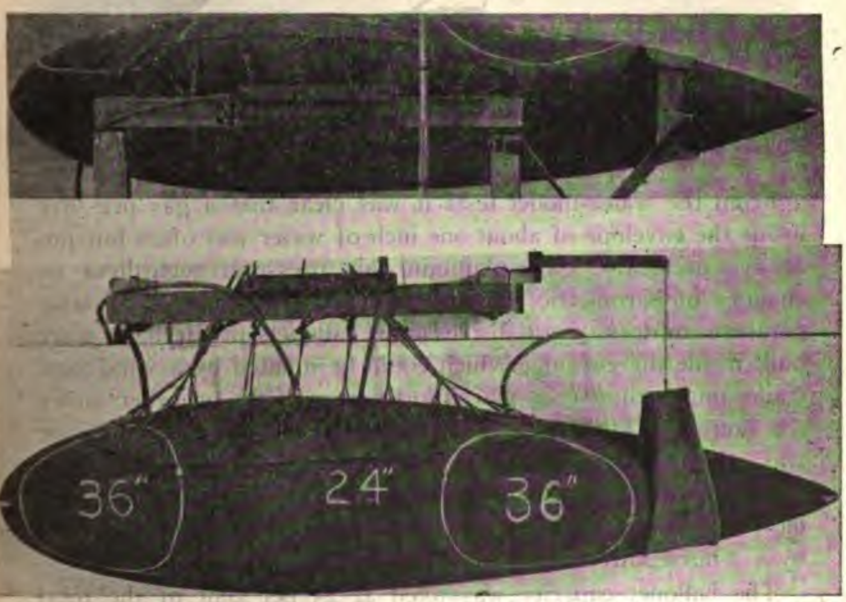


FIG. 4.—Model of B class suspension and envelope filled with water. Note that the fair form of figure 3 is only slightly distorted. The head of water is 24 inches and each internal ballonet is blown up with air to 36 inches pressure as indicated by chalk figures on the outside. The band over the tail represents the weight of fins and rudders and is connected by a string with a bell crank supporting a sand bag.

The water-model tests were made with a 1/30th size model envelope made of the fabric which it was proposed to use, filled with water and suspended in an inverted position by cords arranged as proposed for the actual suspension. The model was, therefore, geometrically similar as to form and suspension to the full sized ship and the theory of the method shows that when tested 1/30th size the stresses and deformations of the envelope are identical with what is to be expected for the ship. Tests were made at different pressures and at different trims to make sure that when climbing or diving nothing abnormal would happen.

FIG. 5.—Early B class airship, showing original double rudders, external air line on belly and air scoop under car. The frontispiece shows the late B class ship with these features eliminated.

From the water-model tests it was clear that a gas pressure inside the envelope of about one inch of water was often but not always necessary. To maintain this pressure, regardless of changes of barometric pressure with altitude, changes of temperature, or loss of gas by leakage, ballonets or air bags were built inside the envelope which could be inflated by a wind pipe connecting with a scoop placed in the rear of the propeller under the bottom of the car. This means of pressure maintenance was, of course, useless if the engine were dead, and to provide for this emergency a blower was inserted in the air line. This blower was an ordinary multivane ventilating blower driven by a 2-horsepower motorcycle engine.

The ballonet capacity was fixed at 25 per cent of the total volume of the envelope. Such a capacity was enough to compen-

sate for the change in pressure incident to a change of 7500 feet in altitude on a normal day. There were two ballonets provided, one in each end of the ship, so that they could, by manipulation of suitable valves, be used as trimming tanks. This system had been used on French and German dirigibles.

The required speed of 45 miles meant that at high speed the nose of the ship would tend to cave in, due to external pressure unless the interior gas pressure were about 2 inches of water. As it was not desired to carry so high a pressure, the nose was stiffened by battens of ash. This feature had been seen on English dirigibles.

The characteristics of the design were as follows:

Length		160 ft.
Diameter		31.5 ft.
Height		50 ft.
Power of main engine		100 H. P.
Power of blower engine		2 H. P.
Maximum speed		45 miles per hour
Cruising speed		35 " " "
Endurance at 45 miles		10 hours
Endurance at 35 miles		16 hours
Gasoline capacity		100 gals.
Ballonet Volume		19,250 cu. ft.
Envelope Volume		77,000 cu. ft.
Gross lift at .068 lbs. per cu. ft.		5,275 lbs.
Weight empty		3,256 lbs.
Instruments, etc.	100	
Blower outfit	100	
Radio outfit	250	
Lighting set	15	
Two men	320	
Fuel and oil	633	
Ballast	290	
Margin	311	
Useful Load, 38 per cent or		2,019 lbs.

By January 6, 1917, the designs and calculations were sufficiently well advanced to indicate that an airship could be built which would materially exceed the military requirements specified by the chief of naval operations in his letter of December 13, 1916, and preliminary plans and specifications were submitted to the Secretary of the Navy. The type was approved by the

general board January 26, 1917 and by the secretary January 27, 1917. At that time it was the intention to build one or two airships as an experiment, but relations with Germany were rapidly becoming strained and on February 17, 1917 the Secretary of the Navy authorized the construction of 16 airships of the type proposed.

In its letter to the Department, the bureau stated that the construction of such a ship was within the capacity of the industrial facilities of the country, but authorization of the construction of 16 of them came as a thunderbolt. To get delivery of such a quantity in any reasonable time seemed at first glance entirely impossible, when it was realized that the work would have to be done by firms entirely unfamiliar with the work and without allowance of time for experiment and research. It was clearly impossible to allow time enough to build an experimental ship to the bureau's design and, after correcting any defects, to proceed with the construction of the other units. This would have been the normal peace time procedure, but six months time was not available and a start had to be made at once.

The chief constructor, therefore, decided to go ahead with the construction regardless of the unproved nature of the design and on February 6, 1917, sent copies of the plans and specifications to five firms which had offered their facilities to the department for war work and which he considered to be in a position to help. Representatives of these five firms met with the chief constructor on February 12 to discuss ways and means for getting the 16 ships built quickly.

The five firms requested to undertake the work were the Curtiss Aeroplane & Motor Corporation of Buffalo, the Connecticut Aircraft Company, and the three great rubber manufacturers, Goodyear, Goodrich and U. S. Rubber. The conference resembled a patriotic meeting rather than a gathering of prospective government contractors, but in spite of a very great desire to help the Navy it was immediately apparent that no one of them was in a position to handle the work. In the first place they were without experience in airship building with the exception of the one unsuccessful attempt of the Connecticut Aircraft Company. None of the rubber companies had ever made fabric of the hydrogen resisting quality and strength required, and it would be necessary not only to develop new processes but to

put in new machinery and special equipment to manufacture it. Supplies of the special fine cotton cloth needed would have to be obtained and the market for it was in an abnormal condition.

None of the firms represented had any building large enough to erect an airship, and though the navy was planning to put up eight airship sheds at coastal stations, the date of completion of such sheds was indefinite and probably too remote to render such sheds available for the first few ships turned out. It was of utmost importance that one ship should be rushed to completion in order to prove the design before the others were too far advanced.

It was agreed at the conference that the manufacturers should form a committee which committee should arrange that each concern would bid for such proportion of the work as appeared to be within its capacity, that the raw materials, information, and experience of all would be pooled both before and during manufacture, and that each would bid a flat price with a guarantee and bond. The present form of cost-plus contract or "Navy Order" was then unknown, and the bid price arrived at was purely an estimate based to a large extent on information from abroad which the bureau made available to the committee. The price agreed upon was about $40,000 per airship with a guarantee to produce a practical ship making more than 35 miles per hour and a guarantee to replace any defective parts for three months. As things worked out, most of the contractors lost money, for the work was done as a rush job and no expense was spared.

The Goodyear Company as the most experienced, having built free balloons for a number of years, was in the best position to go ahead. R. H. Upson and R. A. D. Preston, aeronautical engineers of the Goodyear Company's staff, had had several years experience in designing, making and practical handling of free balloons. They could be relied upon to cope with the present problem. Goodyear agreed to put up at its own expense a complete erection and testing establishment consisting of a field near Akron, O., with a large capacity hydrogen generating plant and an airship shed 200 feet by 100 feet by 100 feet, together with the barracks for the necessary field organization. This decision was reached March 20, 1917, ground was broken for the hangar

and hydrogen plant April 1, 1917, and the first balloon (a free balloon) was inflated in the hangar June 1, 1917.

The Goodrich Company to make up for its lack of experience in making up airship envelopes cabled for M. Juillot, the well-known engineer of the Lebaudy firm in Paris, whom they had been in correspondence with. M. Juillot sailed immediately and later when the United States had declared war on Germany the Department was able to arrange for the release from the French Army of two of M. Juillot's assistants, M. Bourguigon and M. Gautier. These men, together with Mme. Bourguigon who was a skilled fabric worker, were of the greatest assistance in introducing the practical refinements in manufacture about which information was so much needed.

The United States Rubber Company decided not to attempt to build complete airships, but undertook to supply fabric for the Connecticut Aircraft Company.

On March 14, 1917, contracts were awarded as follows: Goodyear nine airships, Goodrich two airships, Curtiss three airships, and Connecticut two airships. The Curtiss Company undertook to supply cars, power plants and fins to Goodyear and Goodrich and later turned over its contract for three complete ships to Goodrich, supplying the same parts for them. Connecticut sub-contracted for its cars and fins with the Pigeon Fràzer Company of Boston and got its power plant from the Hall-Scott Motor Company of San Francisco.

At first great difficulty was had by all concerns in making gas-tight fabric in accordance with the very rigid specifications. These had been based on French practice in requiring a diffusion of only nine liters per square meter for 24 hours (at 15°C and 760 mm.).

The chemical organization necessary to make this rather delicate and elaborate test on a piece cut from each roll of fabric naturally did not exist in the bureau. There were in all about 112,000 yards of fabric to be tested or 2260 rolls. An organization of such magnitude could hardly be improvised effectively, but a way out of the difficulty was found by utilizing existing facilities. The three rubber companies making fabric were required to put in hydrogen diffusion measuring apparatus of a uniform type and to make the tests themselves following a standardized procedure. The bureau contracted with the Pittsburgh

Testing Laboratory, Inc., to supply chemists to supervise the the tests in the contractors' laboratories and to represent the bureau. Finally, as a final check and control on the work, the U. S. Bureau of Standards was asked to put in similar equipment in its chemical laboratory, in order that entirely independent tests and researches on rubberized fabrics might be carried out. In this way most valuable advice and assistance were rendered by the bureau of standards.

When samples of fabric which could pass the specification test were finally turned out, exposure tests were started at the Bureau of Standards, Washington Navy Yard, and at Pensacola Air Station, in order to eliminate those whose life would be short. It was very soon discovered that some apparently very excellent fabric from one contractor perished quickly in strong sunlight, but this was not discovered in time to prevent some of such fabric being used in his first few ships. This is, of course, one of the difficulties of rapid production; there is no time for cautious investigation. However, with the discovery of this phenomenon which seemed to be a matter of oxidization of the rubber compound, the remedy for it was also found and the envelopes made of the early fabric were all replaced by the contractor. During the building of the ships, the fabric was constantly improved and it is safe to say that this improvement was of the order of 500 per cent. This intensive research eventually produced the fabric now used which is found by comparative tests to be superior to the best developed during the war in England, France or Italy.

For some of this improvement, credit must be given to information received from England after the United States declared war. The English methods were of the greatest assistance. With them as a guide, the American manufacturers were able to adopt their own peculiarly American shop practices to work out a fabric which finally equalled the best foreign product.

The Goodyear Company completed the first airship in May, 1917, before their shed at Akron was completed. The Goodrich Company had in the meantime found an abandoned shed at the "White City," Chicago, put it in order and arranged for a large supply of hydrogen in flasks. In order to get a trial of a type ship for the benefit of all contractors, it was arranged to ship the first Goodyear ship to Chicago. The ship was assem-

bled, inflated and given a short flight by Mr. R. H. Upson, of the Goodyear Company. He was so favorably impressed with the results that on the second time up, the weather being favorable, he considered there was less danger in trying to fly home to Akron than in attempting a return to the little field at Chicago which was seriously restricted by buildings and telegraph wires. Accordingly, he headed for Akron at midnight and at noon of the next day, Decoration Day, 1917, landed in a meadow 10 miles from Akron. Had the oil supply held out he could have landed on the Goodyear field, but the motor seized at the last minute.

The flight is remarkable in several particulars. In the first place, it was one of the longest dirigible flights on record up to that time. In the second place, it was a maiden flight of a new airship designed from theoretical and experimental data by a designer of no experience and built in two months by a firm without previous airship experience. In the third place, the flight is astonishing because Mr. Upson was not then an airship pilot and, by our present standards, could not have been expected to handle the ship until he had gone through several weeks' instruction at the hands of an experienced pilot. However, he was an experienced balloonist and as an engineer had a thorough appreciation of how the airship was designed to function.

This flight was very encouraging for the production program, as it proved that the design was all right and permitted the contractors to go ahead with confidence. From then on the ships were delivered with regularity and by the end of the year were operating at the various naval air stations.

The following table gives the dates of delivery of these ships:

No.	Mfg.	Date	No.	Mfg.	Date
B-1......	Goodyear....	July 19, '17.	B-9....	Goodyear....	Jan. 31, '18.
B-5......	Goodyear....	Aug. 11, '17.	B-8....	Goodyear....	Feb. 25, '18.
B-13.....	Goodrich.....	Sept. 11, '17.	B-7....	Goodyear....	Feb. 27, '18.
B-3......	Goodyear....	Oct. 22, '17.	B-6....	Goodyear....	March 3, '18.
B-4......	Goodyear....	Dec. 4, '17.	B-10...	Goodrich.....	April 15, '18.
B-15.....	Connecticut..	Dec. 14, '17.	B-16...	Connecticut..	April 15, '18.
B-14.....	Goodrich.....	Jan. 11, '18.	B-11...	Goodrich.....	May 8, '18.
B-2......	Goodyear....	Jan. 22, '18.	B-12...	Goodrich.....	June 6, '18.

As the airships came along improvements and changes based on experience were incorporated. Suggestions for improvements in details of design came first from the contractors and later, as more navy pilots became trained, a few useful suggestions came from the service. The Goodyear Company proposed many refinements in design which they introduced as a result of the experience of their test pilots, Mr. Upson and Mr. Preston. The enterprise of that firm in providing a flying field at Akron near their works placed them in a position to experiment in the air.

The improvements of most interest were those which led to an increase in speed. The first ships had a speed of about 40 miles per hour. It was found that one of the vertical fins could safely be left off thus cutting down the resistance of one fin and its supporting wires. Later the car was suspended closer to the envelope, shortening the suspension and saving resistance. Still later the suspension itself was simplified and knots and loops cleaned up. A somewhat longer and easier form of envelope gave greater lift and probably less, or at least no more, resistance. The air pipes to the ballonets were placed inside the envelope to save resistance. Improved propellers were developed also. The air scoop finally became only a short sheet metal tube hinged to the envelope proper which could be let down into the slip stream of the propeller or pulled up out of the way, greatly decreasing the resistance and weight of the ship by eliminating the scoop under the car, the blower and air line to the bag.

As a result, the speed was progressingly raised from 40 miles to 48 miles with the same engine. The designed maximum speed was 45 miles per hour, but the contractors were required to guarantee 35 only.

A gratifying feature of the construction was the weight. If the ships had run over the designed weight their usefulness would have been seriously compromised. Fortunately, all ships, including the first of the series, showed a useful lift in excess of the designed load. In some cases it appeared that the structural weights would run over, but in those cases the buoyancy also ran somewhat in excess of the designed figures, leaving a good margin for the useful load.

An automatic gas valve of entirely original design was developed by John R. Gammeter of the Goodrich Company for these airships. This valve has proved to be so reliable, so gas-tight and positive in its operation that it has since been used as standard equipment on the department's later airships and kite balloons.

The ships in service have more than fulfilled all expectations. Designed to cruise for 16 hours, a record on patrol of 40 hours has been made with one of them at Key West. Aside from the short life of the fabric on the first ships, which was replaced, the ships have stood up well, and seven are still in use. One Goodrich ship was in continuous service with its original envelope for 15 months. Another ship, made by Goodyear, kept one inflation of gas for nine months and during this time was in the air 743 hours.

More remarkable still, though flown by all sorts of inexperienced people not a life has been lost as a result of accident. There have been plenty of accidents, in fact, nearly every sort of operating mishap has taken place, but by a combination of good luck, good design, and good construction, the men have been saved.

One ship broke down at sea off Cape May and fell into the water, but remained afloat until the crew could be taken off by a passing schooner. The car was provided with pneumatic floats.

Another ship broke down at sea off Long Island but remained in the air for three days and eventually made a safe landing at Halifax, saving both ship and crew. The valves were tight and the ship could operate as a free balloon.

On a dark night at Akron, an airship collided with a kite balloon which had been left up on the end of a 1000-foot wire. The envelope was torn and the gas released causing the ship to fall. The engine being forward struck the ground first and the crew were piled up on top of it. One of the men was badly hurt.

In the first few months at Akron before anyone had become a really qualified pilot, ships often got into difficulties. One pilot got his ship trimmed over 60 degrees by the head, but the suspension held. Probably a dozen times, ships have become involved with trees. At one time, there was an apparent affinity

for chestnut trees. In no case was any serious damage done except to the envelope. As the pilots became experienced the roosting in trees stopped entirely.

A few gasoline fires have been experienced in the air, but the hydrogen in the envelope never caught fire. The car is suspended well below the envelope, and gas valves are out of the way. In all of these cases the crew put out the fire in time to avert disaster.

One ship at Pensacola had a gasoline fire when on the ground ready to start. The crew jumped out and the handling gang instead of putting out the blaze let go the handling lines. The ship floated away and after a long time the fire reached the hydrogen and she exploded. It is unlikely that such a fire, starting when in the air, would have got any great headway, as the crew would not have been tempted to jump.

Jumping from a dirigible is, of course, always possible, with a parachute, and parachutes are supplied as regular equipment, but now only seldom carried. There has been no case of a crew having to abandon ship via the parachutes, though men have jumped in parachutes for practice. The first man in the United States to jump from an airship going at full speed was Ensign R. Emerson of the Bureau of Construction and Repair, who was responsible for the type of parachute supplied and wanted to make sure of it. The experiment was successful.

The navy's first attempt to design, build and operate airships has been fraught with difficulties, but has been on the whole very successful. This is to some extent due to the modest size selected for the first attempt, but mainly to the energy and enthusiasm of the people concerned, both in and out of the service. The "B" class airships, as these 16 were called, were used at home for training and coast patrol. In France our air forces operated French ships and in England, English ships. But though the B ships had no direct war service, they contributed their mite by training our pilots so that they could go abroad and take over immediately the operation of the foreign types. About 170 pilots were so trained in the United States on B ships before the armistice. In addtion, B ships were used on coast patrol and flew over 13,600 hours or about 400,000 miles.

The B class airships are in no way an improvement over contemporary English airships of the same type and are in some respects less handy and simple, though of greater carrying capacity and endurance. The only noteworthy features are the conditions of their design, manufacture and initial operation. The ships were put into production from plans without waiting for the perfection of an experimental ship.

A long time afterwards, I had the pleasure of talking shop with a British airship designer who had little to say that was complimentary regarding this design. His attitude in general was that we had showed nothing new and, in his opinion, could have improved the design in many features. When I told him that the first ship completed was put through final acceptance trials within four months of placing the contract by a firm without previous experience and by a free balloon pilot without airship training, he was astonished and agreed heartily that the conservative policy adopted had saved months of experimenting. He considered that to put a series of airships into production based wholly on paper designs required either courage or ignorance, or both, and that our successful outcome constituted a "world's record." I had to tell him that a great deal of the design which appeared to him as normal practice required on our part extensive theoretical and experimental research. We had no practical experience to go on, and even such a vital matter as the necessary factors of safety had to be arrived at by a largely theoretical investigation of the possible stresses in operation. Logically enough, we arrived at what is substantially French and British practice which in their case is based on experience with airships built in the past.

After the completion of the B class ships, there was an almost complete stop to airship work in the United States and an improved single engine type which was designed in the winter of 1917-18 was not built. The reason for this was a discouraging report from abroad as to the effectiveness of airships on anti-submarine patrols. But the conclusion drawn from airship operations abroad in the bad winter weather proved to be premature. As the good weather of the spring of 1918 permitted English and French airships to operate more freely, it became apparent that we should proceed immediately with a larger and faster type. Using this time all of the practical experience gained

at home with B class ships and detailed information from abroad with regard to British, French and Italian airships, the bureau undertook to take a step in advance and to design a ship of maximum performance. Full use was made of all available sources of information. In the initial stages of the design the data regarding the performance of British airships, obtained from the British Admiralty through Lieut. Commander P. L.

FIG. 6.—Car of B class ship, showing air scoop underneath, pneumatic floats, parachutes in bucket containers and drag rope hanging over side.

Teed, R. N. V. R., who was attached to the office of the British Naval Attaché at Washington—was especially helpful.

Experience showed the advantages of high speed to cope with winds, great endurance to follow convoys long distances, and a duplicated power plant to lessen chances of complete breakdown at sea. The C class was designed with these ends in view.

To obtain high speed, a new form of envelope and a car of very low resistance were developed from wind-tunnel experi-

ments. The speed was to be obtained by a combination of high power with the utmost refinement in design to keep down resistance. Twin engines were used giving a total of 250 B. H P. The actual speed on trial was 60 miles per hour, making probably the fastest airship of its size ever built.

During the intensive research to improve the B class envelope fabric, it was determined that deterioration was largely caused by the combined action of heat and the actinic rays of sunlight.

FIG. 7.—Car of *C-1*, showing engine mounting, air scoop behind propeller, bomb rack on side, parachute protruding from container, inside fairing on car bottom.

Attempts were made to meet the trouble by filtering out the actinic rays through coloring first the exterior of the fabric, and later the rubber gas film between the plies of cloth. Proper coloring materials were hard to get, and it was usually found that the deterioration resulting from the heat absorbed by the fabric was nearly as rapid as before. About the time the C class design was begun, information from abroad showed that the British airships were suffering from the same troubles and that the most successful protection for the fabric was a coating of aluminum powder, the object of this coating being to

stop all the light from going below the surface of the envelope and to reflect and radiate quickly nearly all the heat. The C class envelopes were made of fabric coated with bright aluminum. This fabric has been found by comparative exposure tests superior to the best developed during the war in England, France and Italy.

The principal dimensions and characteristics of the *C-5*, as weighed off before her start for Newfoundland, were as follows:

Length		192′ 0″
Diameter		41′ 9″
Volume		182,000 cu. ft.
Purity 98.6%, Temperature 65° F., Barometer 30. — Total lift		12,700 lbs.
Weight empty		7,940 lbs.
Weight carried		
Crew (6) men	1015 lbs.	
Fuel	3250 "	
Oil	120 "	
Navigating equipment	25 "	
Radio	250 "	
Food	15 "	
Water for drinking	85 "	
Ballast	0 "	
Useful Load		4,760 lbs.

Endurance at 45 m. p. h., 47 hrs., or 2150 miles.
Endurance at 55 m. p. h., 28 hrs., or 1540 miles.

During 1918, contracts were placed with Goodyear and Goodrich for 30 airships, the cars to be supplied from the Burgess Company, Marblehead, Mass. After the armistice, contracts were reduced to 15 ships.

C-1, the first ship, was completed in September 1918, and on its maiden trip October 22, 1918, flew 400 miles from Akron to Washington in 8¾ hours. It flew over the Navy Department building and landed at Anacostia to permit an inspection by officers of the department. It then preceeded to Rockaway, Long Island. Later in the year, the *C-1* was ordered to Key West and flew down the coast stopping at intermediate air stations.

The *C-5* on May 14, 1919, flew from Montauk to Newfoundland with six men in 25 hours, 50 minutes, a distance of 1022 nautical miles on chart without stop. This flight will remain

for a long time as a notable achievement. The distance actually flown (not being in a straight line) was about 1200 nautical miles or very nearly the distance from Newfoundland to the Azores.

The *C-5* was unfortunately lost at Newfoundland in a gale while moored out in a field and was, therefore, unable to attempt

FIG. 8.—*C-5* landing at Cape May.

the Trans-Atlantic Flight which was within her designed endurance.

The navy's first airships, the B class, were thoroughly practical ships and while not remarkable for performance, are interesting as the solution of a design and production problem. The navy's second lot of airships, the C class, were, in performance, an enormous advance over the B class and placed us at once abreast of the times. These ships are generally admitted to be, for their type, equal to or superior to anything abroad.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE OPPOSITION TO SANE SPORT IN AMERICAN COLLEGES

By FRANK ANGELL

In a late number of the NAVAL INSTITUTE PROCEEDINGS[1] Medical Inspector Taylor, U. S. N., has drawn up a vigorous indictment of the system of sport carried on, or suffered, in most American universities, and that no one may, from the start, mistake the intent of the article, he has entitled it the "Crime of the Colleges." The separate counts in the indictment are to the effect that the system of athletics in vogue in our colleges to-day wastes itself in turning out merely a few highly specialized athletes, that the major sports of football, baseball, track, and rowing are carried on by an insignificant minority of the students whilst the participation in athletic games of the great majority consists in howling from the bleachers in intercollegiate matches. From this follows an over, and often injurious, physical development of the few, and a serious lack of bodily exercise for the many.

The present writer confesses to an experience of about 25 years as chairman of a faculty athletic committee in a university of moderate size, and for fear that this confession may conjure up the vision of an antiquated professor fishing up his arguments in matters athletic from his inkstand, with a desk chair as the *point d'appui* of his experience, he hastens to add that in his sinful youth he was excessively addicted to all kinds of athletic games and has on various occasions played against Annapolis in baseball and football.

It might be comforting to the spirit of a college man if he were able to drive back a vigorous rejoinder to Inspector Taylor's

[1] Refers to November, 1918, issue, No. 189, of the PROCEEDINGS.

straight-from-the-shoulder charge of our collegiate criminality, but except for a feeble rejoinder to the effect that neither the military police nor orders from the Secretaries of War and Navy were required to force West Point and Annapolis into a similar course of crime, there seems to be no "come back." One cannot even counter; the charge is in the main just. "In the main" because in many colleges intramural sports and exercises are carried on with considerable success and more or less enjoyment on the part of the participants. But these sports have no rating alongside the intercollegiate events; by the elect of the "big games" they are endured but not esteemed.

Now three per cent is a liberal estimate for the number of men students in any institution taking part in football; from one and a half to two is the commoner proportion. Similar conditions prevail in track and baseball. As the system goes, football, for example, consists in selecting a few powerful or skilful men, originally handpicked from some high-school where they had undergone a similar process of selection, and then drilling them intensively and monotonously by highly paid coaches to meet a similarly drilled and selected bunch of men in a "big game."

Inspector Taylor's point is that this sort of thing injures men physically. My point is that this grinding drill takes out of a sport its essential element, which is the enjoyment of the player. De facto the game does not exist as a sport; it has become a business —in more senses than one.

In Ciceronian phrase, "since these things exist," why are they so? Why are they not mended by college faculties? Assuredly, the addresses made by college men at the meeting of the National Collegiate Athletic Association in New York last December show that college men are not only aware of the evils of the situation, but are keenly desirous of mending them. The present writer has in his correspondence files two valued letters from presidents of large Eastern universities from which it appears that movements toward reform in athletics in the institutions under their direction had been blocked or hampered by alumni influence. The more demonstrative and noisier elements among the alumni stand for the big games and object to any interference with a system which seems likely to produce them. The "rah-rah and sporty" contingent want to get together at these events for a

"high old time" and do a little patriotic betting. The more solid alumnus wants them for the sake of meeting old friends. Alumni living too far from the scene of hostilities to witness them show their interest in the system, and their patriotism to their alma mater, by making up purses to send back poor but athletically-deserving high-school lads as "material" for teams.

To this sort of thing it may reasonably be objected that the main function of a university is to provide for the welfare of the students actually under its charge, and not to furnish amusement for the alumni and the general public, and further, that the alumni, having had their innings as students, should not stand in the way of changes designed to meet the changed conditions of a later academic generation. But abstract arguments of this sort do not go with many of the more enthusiastic alumni; what they want is big game, the bigger the better, to show the other colleges and the world at large that "old Bohunkus is on the map," and for various and perhaps obvious reasons alumni influence bulks large with university authorities in determining athletic policy.

But alumni influence is not the only, nor indeed the chief, influencing factor in making for a misshapen development of college sports. A more potent and more demoralizing factor is commercialization, and, be it said straightway, commercialization is not widely remote from professionalization.

An issue of the New York *Evening Post* a few months back is authority for the statement that one Glenn Warner was paid some $8000 for ten weeks of service in coaching the University of Pittsburg football team—not the Pirates of baseball fame, but a 'varsity team. What is the difference? Well, the writer lives too far distant to discriminate fairly the *nuances* in the situation. Perhaps the gentlemen backing the 'varsity team got more of a run for their money in football than in baseball. But if Pittsburg sins, it sins in good company; respectable old Harvard with its enormous football budget is hardly in a position to point the finger of scorn at Pittsburg. In fact, all over the country, in a large majority of the colleges, the expenses of football, and to a less degree, of the other sports, are excessive, inordinate and demoralizing. The parasitic growths—coaches, rubbers, trainers, training-tables, lavish equipment—demand "big gate money," and consequently big games. Big games in their turn, as played

here, call for the parasitic growths. And so the vicious circle is closed and goes eddying around a sort of financial maelstrom.

But a system of this kind does not whirl along the high water of finance without impulsion from certain outside forces—forces which are various in origin but united in their push towards the business side of things. First of these comes the not very ancient and not entirely honorable guild of mercenary coaches. The love of sport for sport's sake developed in these gentlemen, is hardly sufficient to bring them to look with complacency on changes in the athletic régime which might cut their emoluments down to figures within the reach of assistant or associate professors. In fact, they might be dropped into a state of "innocuous desuetude" altogether, if ever the principle of development of leadership through athletic sports should get a foothold in the colleges.

They have worked persistently, though not too conspicuously, in behalf of big games and big gate receipts, and inasmuch as a successful coach, in undergraduate opinion, considerably outranks in importance the president of a college, it cannot be said that the coach's influence is a negligble quantity in equating the ticket office with the field of play. As auxiliaries to the small but heavy-armed phalanx of coaches we find the writers of sporting news for the daily press and the agents of sporting goods houses who also fail to "see reasons" for changing a system which brings shekels into their purses.

Now at this point emerges a well-known argument which few colleges in the United States feel they are in a position to meet with satisfaction to themselves or to the reformers. It runs as follows: "If you do not make money from games how are you going to finance them? If you do not draw big crowds in football and charge all the traffic will bear how are you going to carry on sports at large?" For most colleges the question is a serious problem; their athletic fields are commonly limited to a "diamond" together with a football field surrounded by a track, an admirable arrangement for converting sports into shows and hippodromes. For other colleges the situation presents no problem at all; they deliberately plan to let the sports pay for themselves and regard the arrangement as a clever piece of academic economy. What such a plan leads to we have seen above. Manifestly it is the duty of a college to provide sufficient grounds for general participation in sports and to maintain them in fitting condition

together with what may be termed their proper permanent improvements—hot and cold showers, dressing-rooms and lockers. The day for regarding college sports merely as idle play has long gone by; no sane man who has watched college "athletics" has failed to see their potency in character building and their powerful influence for good or bad on academic life.

If proper provision were made for the "educational values" of sport, to use pedagogical parlance, it is evident that a good deal of wind would be taken out of the sails of the commercial argument, and even where no such provision has been made, a vigorous lopping off of the parasitic expenses of intercollegiate games would take from the "sport for revenue" argument considerable of its headway.

But granting a sufficiency of fields and a reasonable bill of expense in our sports, would general participation in them follow? Not necessarily, and perhaps not probably. Many generations of college students have grown up whose view of sports is bounded by the "team," the big game, and the bleachers, and college traditions of this kind have a tenacity of grip which usually requires a surgical operation by the faculty to unloose. Moreover, in the case of fall sports there would still remain the very greatest obstacle to general participation and that is the game of American football.

From the coaches' premonitory "now fellers" to the final blast of the whistle, American football is an intercollegiate event *sang pur*. In no sense is it a sport in the sense in which Rugby football, soccer, la crosse, and polo are sports, nor is it played in a like spirit. It is played by undergraduates for many reasons, but the pleasure of the play and sport for sport's sake are not conspicuous among them. It is a game for coaches, of coaches and by coaches, and a team is as frequently known by the name of its coach as by its college. In short, as one of our players remarked. "It's a bully game for the coaches." Attempts to make it a "general sport" have rarely succeeded and where successful it has only been through assiduous dry-nursing with quick and long relapses. If left to the step-motherly treatment meted out to soccer in our colleges, it would collapse altogether.

Now, the main reason for this is not far to seek; it is a signal game. It presupposes a team of 11 men drilled by arduous and monotonous practice in a series of signals to make concerted

plays. It also presupposes another team of 11 men similarly drilled but with a different set of signals. Neither team may know the other team's signals. It usually calls in addition for a drill master in the shape of the coach who commonly works up the signals and the plays. As our colleges are constituted such an arrangement militates in the strongest way against any broad participation in football, even if the grind of practice and the list of injuries did not work in the same direction. The writer is not entering here into a discussion of the numerous objections that have been made to American football as a game: the ignorance of football technique of a majority of a team, the exhausting and mechanical character of the plays, the premium placed on weight as against dexterity, the expense of the outfit, the dependence on the coach, and the suppression of leadership. The point at issue is that the constitution of the game is such that it blocks the way for general participation.

When therefore a mere college faculty starts out to expiate the crime of the college against sane athletics by measures of reform, it finds itself up against a serried army of opposing powers, the influence of alumni and sometimes of trustees, a firmly entrenched commercialism, and student tradition.

And the hottest focus for all these influences may be found in the American game of football.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

TRAJECTORIES AND THEIR CORRECTIONS

By LIEUT. COMMANDER A. G. KIRK, U. S. Navy

In the Naval Institute issue for January, 1919, whole No. 191, is published an article by Captain E. F. Eggert, Construction Corps, U. S. Navy, descriptive of a method of computing trajectories by mechanical integration. The method is essentially similar to that already in use by the Ordnance Department of the army, and now being adopted at the naval proving grounds for long-range work. The present system was developed by Professor F. R. Moulton, Professor of Astronomy at Chicago University, while serving as major in the ordnance reserve corps of the army during the war. And it is gratifying to find that from within the regular navy should come a scheme whose general principles are identical. Major Moulton's method, however, has several refinements of detail so that it will be of interest to reproduce it. Likewise Professor G. A. Bliss, at the Aberdeen Proving Ground, has developed a system of differential corrections to the undisturbed trajectory from which so-called weighting factor curves are drawn. From these differential corrections and weighting factor curves the calculated trajectories can be corrected accurately for all variations from standard conditions—muzzle velocity, angle of departure, wind, density of the air, and particularly wind and density which vary at different altitudes.

The reasons why the old methods of Alger and Ingalls must be discarded for long-range work have been clearly shown. The quantities β and f_a are not known, and any assumptions of their values are bound to be in error. The only way of finding them is by calculating backwards from observed ranges, and even this cannot be done accurately unless the observed ranges are corrected for all variations from standard conditions. By mechanical

integration these errors are entirely eliminated and the method is equally accurate for all angles of elevation from 0° to 90°.

THE THREE BASIC ASSUMPTIONS

There are three assumptions that have to be made in all work in exterior ballistics.

1. It must be assumed that the axis of the shell stays close enough to the tangent to the trajectory to insure that the resistance of the air acts along this tangent. We know that this is not the case in the horizontal plane for we get the phenomenon of drift, but by the present method of calculation, trajectories have been plotted and found to agree accurately with the trajectories plotted from observations of the bursts of explosive shell timed to burst at various points in their flight. In the vertical plane, therefore, this assumption appears to be generally true.

2. It must be assumed that the experiments from which the resistance of the air has been calculated are accurate, and that results hold for all types of shell provided the proper ballistic coefficient is used. No experimental data of this nature can be considered absolute and slight changes will come as new experiments are carried out. The old resistance formulæ of Mayevski have been superseded by new tables in which the function is continuous. This is called the *G*-function and is actually the retardation caused by air of unit density on a projectile of unit ballistic coefficient divided by the velocity at which the shell is traveling. The whole table is in metric units.

3. The last assumption is that the tables for the density of the air at all altitudes are accurate. This assumption is less open to criticism than either of the above, for in the first place a great deal of experimentation has been carried out along this line, and in the second place the differential corrections take care of differences in the density of the upper air from those assumed in the original computation. This function is called the *H*-function. In the old method the constant *f*, or *fa*, is a mean value of this *H*-function.

THE COMPUTATION OF THE UNDISTURBED TRAJECTORY

These assumptions are fundamentally those of Captain Eggert with the difference that the retardation values are derived from

more recent experiments. Since the G-function is the retardation divided by the velocity a new symbol has to be introduced to replace R, the retardation. This symbol has been denoted as F and is equal to $\frac{R}{V}$. For any shell, whose ballistic coefficient is C, at any height, and traveling at any velocity, $F=\frac{1}{C}GH$; also $FV=R$. Using the usual system of coordinates with the X-axis horizontal and positive down the range and the Y-axis vertical and positive upwards, let us denote the accelerations and velocities parallel to the X-axis as X'' and X' respectively and those parallel to the Y-axis as Y'' and Y'. Now the only forces acting on the shell in space are the resistance of the air and gravity. Resolving the retardation or negative acceleration caused by the air into its vertical and horizontal components, R_x and R_y, we get

$$\left.\begin{aligned} X''&=R_x=-FX' \\ Y''&=R_y-g=-FY'-g \end{aligned}\right\} \qquad \text{(a)}$$

These are Captain Eggert's equations in a slightly different form, and the only method of solving them is by mechanical integration.

Before going on with the integration process let us first examine the function F. F is a product of three things, the reciprocal of the ballistic coefficient, $C=\frac{W}{id^2}$, the G-function, and the H-function. C is known for the shell and is constant throughout the trajectory. G is determined by the velocity. Except at the muzzle of the gun the velocity itself is not known, but its two components X' and Y' are. $V^2=X'^2+Y'^2$, however, so that squaring and adding these two components will give us the square of the velocity. To simplify the looking up of G, the G-table is made with $\frac{V^2}{100}$ as argument and the table itself gives the logarithm of G. H is determined completely by the altitude Y and the logarithm of H is tabulated with Y as argument. The logarithm of F is the sum of the logarithms of G and H and the colog. of C. A small form, Fig. 1, has been arranged so that this work can be done very simply with four-place tables. It will be found quicker to use the four-place tables than a slide rule and table of squares, for a four-place table can be worked entirely with one hand.

The process of integrating mechanically these equations with accuracy is slightly more complicated than Captain Eggert assumes. If values of FX' at the beginning and end of a small time interval, Δt, are known he states that the integral of FX', or in other words

COMPUTING SHEET

$M.V. = 792.5$ m/s (2600 f. s.)
$C = 11.89$
$\Phi = 12°-52'-30''$

t	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2	3	4	5	6
log G........	94712	94678	94644	94611	94580	94517	94458	94400	94344
log H........	00000	99964	99929	99896	99864	99804	99749	99699	99655
colog C......	89248	89248	89248	89248	89248	89248	89248	89248	89248
log x'........	28880	28826	28773	28721	28670	28569	28473	28378	28284
log F........	83960	83890	83821	83755	83692	83569	83455	83347	83247
log y'........	22470	22294	22114	21928	21738	21338	20913	20453	19952
log Fx'.......	12840	12716	12594	12476	12362	12138	11928	11725	11531
log Fy'.......	06430	06184	05935	05683	05430	04907	04368	03800	03199
$\frac{x'^2}{100}$..........	59690	58235	56835	55485	54200	51756	49490	47370	45390
$\frac{y'^2}{100}$..........	3118	2878	2648	2427	2226	1853	1522	1230	978
$\frac{v^2}{100}$..........	62808	61113	59483	57912	56426	53609	51012	48600	46368
Fx'..........	1923	1869	1817	1768	1723	1636	1559	1488	1423
g...........	981	981	981	981	981	981	981	981	981
Fy'..........	440	415	392	370	349	310	273	240	209
$Fy'+g$......	1421	1396	1373	1351	1330	1291	1254	1221	1190

FIG. 1.

the increment of X' for that period, is the product of Δt and the mean value of FX'. If Δt is infinitely small this is true, but Δt cannot be made infinitely small, so further refinements must be introduced. Assuming that FX' is known at the end of a succession of equal time intervals of length Δt, call the differences between these successive values $\Delta_1 FX'$; and the differences of

these $\Delta_1 FX''s$ call $\Delta_2 FX'$; and so on. Then at any point the integral of FX' throughout the interval Δt, or $\Delta X'$, becomes

$$\Delta X' = \Delta t(FX' - \tfrac{1}{2}\Delta_1 FX' - \tfrac{1}{12}\Delta_2 FX' - \tfrac{1}{24}\Delta_3 FX' \ldots\ldots).^* \quad \text{(b)}$$

The first two terms only of this parenthesis are used by Captain Eggert and at least near the beginning of the trajectory, when values are changing rapidly, considerable errors will creep in thereby. To evaluate $\Delta Y'$ at any time interval, the same formula is used by substituting for FX' and its difference, $-(FY'+g)$ and its differences. And again for getting ΔX and ΔY, from X' and Y' and their differences.

It is usual to begin the computation by using values of Δt of $\frac{1}{2}$ second, or $\frac{1}{4}$ second. The smaller the interval, the smoother will run the differences. As soon as the second or third differences, depending upon the number of significant figures employed, begin to run uniformly the interval may be extended. When $\frac{1}{2}$-second values of Δt have been used at the beginning, the increase is made to 1-second intervals. Again, these intervals are extended to 2 seconds when indicated by the smoothness of the results. Mistakes are detected by irregularities in the differences, and each integration can be checked from the computation (Fig. 1). The important point is to remember the integration follows the equation (b), and that the functions themselves have the algebraic sign from the original equations (a). Also, that the difference columns keep the proper algebraic sign, noting that first differences, for example, are the result of substracting the value of the function at the previous time interval from its value at this time interval. Similarly for second and other differences. Most of the numerical work can be done mentally and results written down directly. As a matter of practice the algebraic signs are rarely written into the form; they must be carefully watched, however. With experience

* When $A_t = \int_0^t f(t)\,dt$ and the differences of $f(t)$ are $\Delta_1 f$, $\Delta_2 f$, $\Delta_3 f$, and so on, the formula for short-arc integration is

$$A_{t_{n+1}} - A_{t_n} = \int_0^{t_{n+1}} f(t)\,dt - \int_0^{t_n} f(t)\,dt$$
$$= (t_{n+1} - t_n)\,(f(t)_{n+1} - \tfrac{1}{2}\Delta_1 f - \tfrac{1}{12}\Delta_2 f - \tfrac{1}{24}\Delta_3 f \ldots).$$

This is the fundamental equation of short-arc integration and is accurate for this type of function. As written in the text, the equation is simpler and perhaps more easily understood.

the computation goes ahead smoothly and quickly. Two decimal places are preserved for the values of FX' and $-Fy'-g$; one decimal place for Y', Y, X' and X. In changing the time-interval from 1 to 2 seconds for example, values of Y, Y', $-FY'-g$, $-FX'$ and X' are written down for, say, 2, 4, and 6 seconds. From these values Δ_1, Δ_2, and Δ_3 are put down, and the computation continued as before. In the 2-second interval, it will be found that

$$(t_{n+1}-t_n)\ \left(f(t)_{n+1}-\tfrac{1}{2}\Delta_1 f-\tfrac{1}{12}\Delta_2 f-\tfrac{1}{24}\Delta_3 f\ldots\right)$$

becomes

$$f(t)_{n+1}+f(t)_n-\tfrac{1}{8}\Delta_2 f.$$

So that in getting, say, Y' from Y'', the values of the Y''-function are added together and then $\frac{1}{8}$ of their second differences applied, keeping watch on the sign of Δ_2.

When the computed values of $-FX'$ and $-(FY'+g)$ differ by more than two in the last significant figure, from the assumed values, the computation must be done over again with the corrected values. When two or less, the assumed values are corrected, but the computation is not. After the trajectory is running smoothly, the values of $-FX'$ and $-FY'-g$ are sometimes only computed every other step.

Of course the initial values of X' and Y' are known:

$$X'=V\cos\phi\,;\ Y'=V\sin\phi,$$

and X and Y are zero; likewise $t=0$. X gradually increases throughout the trajectory. Y increases to the maximum ordinate, Y_0, and then decreases to zero. $-FY'-g$ must be watched for algebraic sign as the shell approaches the maximum ordinate, and so must the sign of the integral of $-FY'-g$. Y rarely becomes zero the second time, when the shell lands, on an even time interval: double interpolation is here necessary. Likewise, for Y', X', X, T and F. By double interpolation approximate values only are obtained. Exact values are found by getting the mean value of the vertical velocity, Y', during the last time interval. Dividing the last positive value of Y by this mean vertical velocity, gives the time taken by the projectile to reach the ground from that point. This time interval added to the time of the last computed point gives the total time of flight. Exact values of X, X', and Y' are obtained by multiplying the mean rate of change of these quantities, between the last computed point and the total time, by the fractional time interval obtained above. Applying these

values to the last computed values, gives the exact values of X, X', **and** Y when $Y=0$. The value of X when $Y=0$ is the total range. $\frac{X'}{Y'}=\omega$ gives the angle of fall. $V_\omega=\sqrt{X'^2+Y'^2}$ is the striking **velocity**.

After the trajectory has been computed, the values of F are **carried** to five significant figures and should run very smoothly. **They** form an excellent check on the accuracy of the computation.

In working long-range trajectories the values of Y must be **corrected** for the curvature of the earth. Likewise the effect of **gravity** changes in a long trajectory, and has both a vertical and **horizontal** component which enter into the values of X'' and Y''. **For** these corrections, tables have been prepared which the computer keeps at hand and uses as the occasion demands.

As a matter of interest, the same trajectory used by Captain **Eggert** has been computed by Major Moulton's method and is **shown** as Fig. 2.

TERMINAL RESULTS FROM FIGURE 2

For an approximate T; $\frac{-6.9}{143.9}=-.05$. Hence, $T=31.95\pm y'$ at 31.975 (mean of 32.0 and 31.95) $=-\left(143.9-\frac{.025}{2}\,15.1\right)=-143.7$.

Final $T=32.0-\frac{6.9}{143.7}=31.952$ sec.

For range: Mean of 32.0 and $31.952=31.976$.

X' at $31.976=423.5+\frac{.024}{2}\,14.4=423.7$.

$423.7\times.048=2.0$.

$18207.3-2.0=18205.3$ m. = range = 19909.9 yds.

$X_\omega'=423.5-.048\times7.07=423.8$ m./s.

$Y_\omega'=143.9-.048\times7.41=143.5$ m./s.

$V_\omega=447.4$ m./s. $=1467.9$ f./s.

$\tan\omega=0.3386=18^\circ-42'.4$.

For Y_0; $Y''=0$, at approximate $t=16-\frac{8.0}{9.67}=16-0.8=15.2$.

Mean of 15.2 and $16.0=15.6$. At this time $Fy'+g=9.74$; therefore, corrected time $=16-\frac{8.0}{9.74}=15.18$.

Mean of 16 and $15.18=15.59$, at this time $y'=-4.0$.

GL = 16"/45
I ILE = Long point A.P.
= None

COMPUTATION OF TRA

			X'			-FX'			F
000			7726			-1923			02469
3839	3839		7631	95		1869	154		2449
7632	3793		7539	92	3	1817	52	-2	2410
11379	3747		7449	90	2	1768	49	3	2374
15082	3703		7362	87	3	1723	45	4	2340
000			7726			1923			2469
7632	7632		7539	187		1817	106		2410
15082	7450	182	7362	177	10	1723	94	-12	2340
22359	7277	173	7194	168	9	1636	87	7	2275
29473	7114	163	7035	159	9	1559	77	10	2215
36431	6958	156	6883	152	7	1488	71	6	2161
43240	6809	149	6737	146	6	1423	65	6	2112
49907	6667	142	6598	139	7	1364	59	6	2067
56438	6531	136	6465	133	6	1309	55	4	2025
62839	6401	130	6337	128	5	1259	50	5	1987
69114	6275	126	6213	124	4	1212	47	4	1951
43240			6737			1423			2112
56438	13198		6465	272		1309	114		2025
69114	12676		6213	252	20	1212	97	-17	1951
81303	12189		5979	234	18	1129	83	14	1889
93039	11736		5760	219	15	1057	72	11	1835
104352	11313		5555	205	14	995	62	10	1790
115267	10915		5362	193	12	940	55	7	1753
125806	10539		5179	183	10	892	48	7	1723
135988	10182		5005	174	9	850	42	6	1699
145831	9843		4839	166	8	813	37	5	1681
155349	9518		4680	159	7	781	32	5	1670
164555	9206		4527	153	6	753	28	4	1664
173460	8906		4379	148	5	729	24	4	1664
182073	8613		4235	144	4	707	22	2	1669

FOR MUZZLE VELOCITY = [illegible] DATE 11 March 1917
BALLISTIC COEFFICIENT [illegible]
ANGLE OF PROJECTION [illegible] COMPUTED BY [illegible]

	y								
000				1788			-1421		
848	845			1696	-72		1394	-23	
1696	831	34		1627	69	11	1373	27	-4
2492	797	34		1529	68	1	1352	22	1
3256	763	34		1492	67	1	1330	21	1
000				1788			1421		
1696	1696			1627	139		1373	49	
3256	1560	136		1492	135	4	1330	43	6
4683	1427	133		1361	131	4	1291	39	4
5980	1297	130		1234	127	4	1254	37	2
7152	1172	125		1110	124	3	1221	33	4
8201	1049	123		989	121	3	1190	31	2
9131	930	119		871	118	3	1161	29	2
9945	814	116		756	115	3	1134	27	2
10646	700	114		644	112	3	1109	25	2
11234	589	111		534	110	2	1085	24	1
8201				989			1190		
9945	1744			756	233		1134	56	
11234	1289	455		534	222	11	1085	49	7
12088	854	435	20	321	213	9	1042	-46	6
12524	436	418	17	117	204	9	1003	39	7
12560	36	400	18	(-) 80	197	7	967	36	3
12209	(-) 351	367	13	270	190	7	934	33	3
11484	725	374	13	454	184	6	903	31	2
10397	1087	362	12	632	178	6	874	29	2
8960	1437	350	12	804	172	6	846	28	1
7184	1776	339	11	971	167	5	819	27	1
5080	2104	328	11	1132	161	6	793	26	1
2659	2421	317	11	1288	156	5	767	26	0
(-) 69	2728	307	10	1439	151	5	741	26	0

$y_0 = 1256.0 - (-4.0) \times 0.82 = 1259.3$ m. $= 4131.5$ ft. $=$ maximum ordinate.

Method	i	ϕ	R	T	ω	V_ω	Y_0
Siacci	.70	12° 52½′	20,000	32.06	18° 42′	1485	4155
Small-arcs .	.69	12° 52½′	19,910	31.95	18° 42.′4	1468	4131.5

This much of Major Moulton's method is fairly simple. The terminal results of the $\frac{16''}{45}$ problem compare favorably with the Siacci method, and are close to those found by Captain Eggert. The two short arc computations would scarcely show much variation with so large a ballistic coefficient and at so short a range. It is, however, in the field of providing suitable means to correct a disturbed trajectory that Major Moulton's method has its great advantage. This brings us to the second phase of the new method.

CORRECTIONS TO THE TRAJECTORY

The differential corrections to the trajectory have been designed to take care of

(a) differences in angle of departure.
(b) differences in muzzle velocity.
(c) change in range of wind component in the plane of fire.
(d) variations in density, or ballistic coefficient.
(e) cross-wind component.
(f) effect of rotation of the earth, on both range and deflection.

The equations themselves and the adjoint system of equations used in solving them are too long and complicated for the purpose of this article. The final equations which are ordinarily used, are two

$$\Delta R = [\lambda_1 \xi' - \mu_1 \eta']^{t=0} + \int_0^T W_x(\lambda_1 + 1)\,dt - \int_T^t F(X'\lambda_1 + \mu_1 \gamma')\frac{dk}{k}\,dt. \quad (1)$$

Where the first term is the change in range corresponding to (a) and (b) above; the second term is (c); and the third term is (d).

The other equation is

$$\xi_w = [T + V_1(T) - (t_0 + V_1(t_0))]W_z, \quad (2)$$

which takes care of the cross-wind component (e). The equations for compensating for the rotation of the earth are omitted.

The process of getting values of the different parameters, their collection into the various components of the terms of equations (1) and (2), and their arrangement on a workable basis is shown

in Fig. 3. The small-arc integration is simple: two functions have to be guessed independently (μ_1' and λ_1'), tables of $\frac{1}{Gv} \cdot \frac{\delta G}{\delta y}$, and $\frac{1}{H} \frac{\delta H}{\delta Y}$ are at hand, F, X' and Y' come from the original trajectory, and a slide rule or omnimetre suffices for the computations. The integrations are a little complicated at the start for the initial values of the functions $\lambda, \mu, \nu, \lambda_1, \mu_1, \nu_1$, taken when $t=T$, are $(1, \cot \omega, 0, 0, 0, 0)$. Thus the value of Δt for the first integration is, in this example, -1.95 seconds, and the sign of Δt is negative throughout. The solution requires about the same length of time as the original trajectory.

WEIGHTING-FACTOR CURVES

The method of handling the results of the computations of the differential corrections is to plot the values of the functions against the ratio of the various ordinates to the maximum ordinate. When it is understood that the numerical values of the different terms of equation (1) at the time t represent the effect of the unit disturbance upon that portion of the trajectory lying above the particular value of Y, it is evident that by employing percentage values of the maximum ordinate, results for different elevations may be plotted on the same sheet.

Suppose in the case of the $\frac{16''}{45}$ gun under the given conditions we plot using values of $\frac{Y}{Y_0}$. A form is then arranged and filled out as shown in Fig. 4. The first line contains the time intervals. The second line the corresponding values of Y. The third line has the values $t+\lambda_1(t)$, or the change of range caused by a unit wind blowing in the line of fire on the trajectory after the time t. The fifth line contains the values of the change in range due to variations of 1 per cent in the density of the air or the ballistic coefficient. The last line is the cross wind. The curves plotted from these results are also shown in Fig. 4. The intercept on the X-axis is the effect of the unit disturbance acting throughout the entire trajectory. Any intercept parallel to and lying above the X-axis, shows the effect of a unit disturbance acting throughout that portion of the trajectory lying above the particular ratio of $\frac{Y}{Y_0}$. For

T	31.95	30	28	26	24	22	20	18	16
F	01669	01664	01664	01670	01681	01699	01723	01753	01790
X'	4258	4379	4587	4680	4839	5005	5179	5363	5556
Y'	-1435	-1288	-1132	-971	-804	-632	-454	-270	[illegible]
$\frac{1}{gv}\frac{\partial G}{\partial V}$	$0_5 571$	$0_5 528$	$0_5 479$	$0_5 423$	$0_5 376$	$0_5 332$	$0_5 291$	$0_5 256$	$0_5 224$
$\frac{1}{H}\frac{\partial H}{\partial y}$	$-0_4 960$	$-0_4 965$	$-0_4 970$	$-0_4 974$	$-0_4 978$	$-0_4 981$	$-0_4 983$	$-0_4 984$	$-0_4 985$
(A) $\frac{FX'}{gv}\frac{\partial G}{\partial V}$	$0_4 404$	$0_4 385$	$0_4 361$	$0_4 332$	$0_4 305$	$0_4 282$	$0_4 260$	$0_4 241$	$0_4 222$
(B) $\frac{FY'}{gv}\frac{\partial G}{\partial V}$	$-0_4 137$	$-0_4 115$	$-0_5 910$	$-0_5 695$	$-0_5 508$	$-0_5 356$	$-0_5 220$	$-0_5 121$	-0_5 [illegible]
(C) $\frac{F}{H}\frac{\partial H}{\partial y}$	$-0_5 160$	$-0_5 160$	$-0_5 161$	$-0_5 163$	$-0_5 164$	$-0_5 167$	$-0_5 170$	$-0_5 173$	$-0_5 176$
(1) $\lambda_1 X'$	0	852	1721	2620	3536	4460	5390	6320	7260
(2) $\mu_1 Y'$	0	-735	-1265	-1633	-1778	-1722	-1466	-1000	-333
(3) = (1) + (2)	0	100	456	987	1757	2738	3914	5320	6917
$F(3)$	0	17	76	16	29	46	67	93	124
Δ_1		17	5	9	13	17	21	26	31
Δ_2			3	4	4	4	4	5	5
$\int F(3)$	0	20	10	32	76	150	262	421	637
$(C)(3) = \mu'$	0	$-0_3 16$	$-0_3 7$	$-0_2 16$	$-0_2 28$	-005	-007	-009	-01
Δ_1									
Δ_2									
μ	297	297	297	297	297	298	299	300	302
(4) $F\mu_1$	0	094	19	30	37	46	56	65	75
(5) (B)(3)	0	$-0_2 12$	$-0_2 4$	$-0_2 7$	-01	-01	-01	-01	00
(4) + (5) − μ = μ_1'	-297	-298	-278	-269	-261	-253	-245	-236	-227
Δ_1		09	10	09	08	08	08	09	09
Δ_2			-01	01	-01	00	00	01	00
μ_1	0	568	1134	1661	2211	2725	3223	3704	4167
(6) $F\lambda_1 - 1$	-1	-97	-94	-91	-88	-85	-82	-79	-77
(7) (A)(3)	0	$0_2 38$	016	03	05	08	10	13	15
(6) + (7) = λ_1'	-1	-97	-92	-88	-83	-77	-72	-66	-62
Δ_1		03	05	04	05	06	05	06	06
Δ_2			02	-01	01	01	-01	01	-00
λ_1	0	191	380	560	731	891	1040	1178	1306
$F\nu_1 - 1 = \nu_1'$	-1	-97	-94	-92	-87	-84	-81	-78	-76
Δ_1		03	03	03	03	03	03	03	03
Δ_2			00	00	01	-01	00	00	00
ν_1	0	191	382	567	748	925	1097	1260	1425

10	9	8	7	6	5	4	3	2	1	0
01951	01987	02025	02067	02112	02161	02215	02275	02340	02410	02489
6233	6337	6465	6598	6737	6883	7036	7194	7382	7639	7756
554	646	736	831	989	1130	1234	1381	1498	1587	1756
$0_5 152$	$0_5 142$	$0_5 135$	$0_5 128$	$0_5 120$	$0_5 112$	$0_6 106$	$0_5 108$	$0_5 991$	$0_6 960$	$0_6 930$
$-0_4 982$	$-0_4 981$	$-0_4 980$	$-0_4 978$	$-0_4 976$	$-0_4 974$	$-0_4 972$	$-0_4 969$	$-0_4 966$	$-0_4 963$	$-0_4 960$
$0_4 184$	$0_4 179$	$0_4 177$	$0_4 174$	$0_4 171$	$0_4 167$	$0_4 168$	$0_4 167$	$0_4 171$	$0_4 174$	$0_4 179$
$0_5 156$	$0_5 182$	$0_5 207$	$0_5 230$	$0_5 251$	$0_5 267$	$0_5 290$	$0_5 318$	$0_5 345$	$0_5 376$	$0_5 408$
$-0_5 192$	$-0_5 196$	$-0_5 198$	$-0_5 202$	$-0_5 206$	$-0_5 210$	$-0_5 215$	$-0_5 220$	$-0_5 226$	$-0_5 232$	$-0_5 239$
[illegible]	10660	11060	11600	12060	12440	12960	13340	13790	14200	14630
[illegible]	3646	4425	5680	6160	7130	8150	9240	10360	11600	12870
[illegible]	14205	15471	16780	18020	19570	21010	22580	24140	25900	27600
254	282	313	345	382	422	466	513	565	622	684
[illegible]	28	31	33	36	40	44	47	52	57	62
[illegible]	3	3	2	3	4	4	3	5	5	6
[illegible]	1906	2203	2632	2796	3190	3642	4182	4671	5265	5918
−02	−03	−03	−03	−04	−04	−04	−05	−05	−06	−07
321	314	323	320	324	368	302	337	342	348	365
106	115	119	128	132	139	146	154	163	172	182
02	02	05	04	05	05	06	07	08	10	11
202	−199	−178	−191	−187	−184	−180	−176	−171	−166	−118
06	04	04	06	04	05	04	04	05	06	04
00	01	02	00	00	−01	10	00	01	00	−01
5407	5658	5856	6048	6237	6423	6605	6783	6957	7126	7290
58	−57	−56	−54	−53	−57	−59	−58	−56	−65	−53
24	26	27	29	31	33	35	38	41	45	49
13	−37	−36	−30	−28	−26	−24	−20	−16	−10	−04
[illegible]	02	04	02	03	04	04	04	05	05	06
[illegible]	−01	02	−01	00	01	00	00	01	00	01
[illegible]	1657	1707	1743	1776	1806	1832	1864	1870	1886	1892
68	−65	−61	−59	−57	−55	−52	−50	−47	−44	−41
[illegible]	02	02	02	02	02	03	02	03	03	03
[illegible]	−01	00	00	00	00	−01	−01	01	00	00
[illegible]	1877	1926	1999	2087	2113	2167	2216	2267	2312	2355

C CROSS SECTION
[illegible] TO HALF AN INCH
No 354

agk

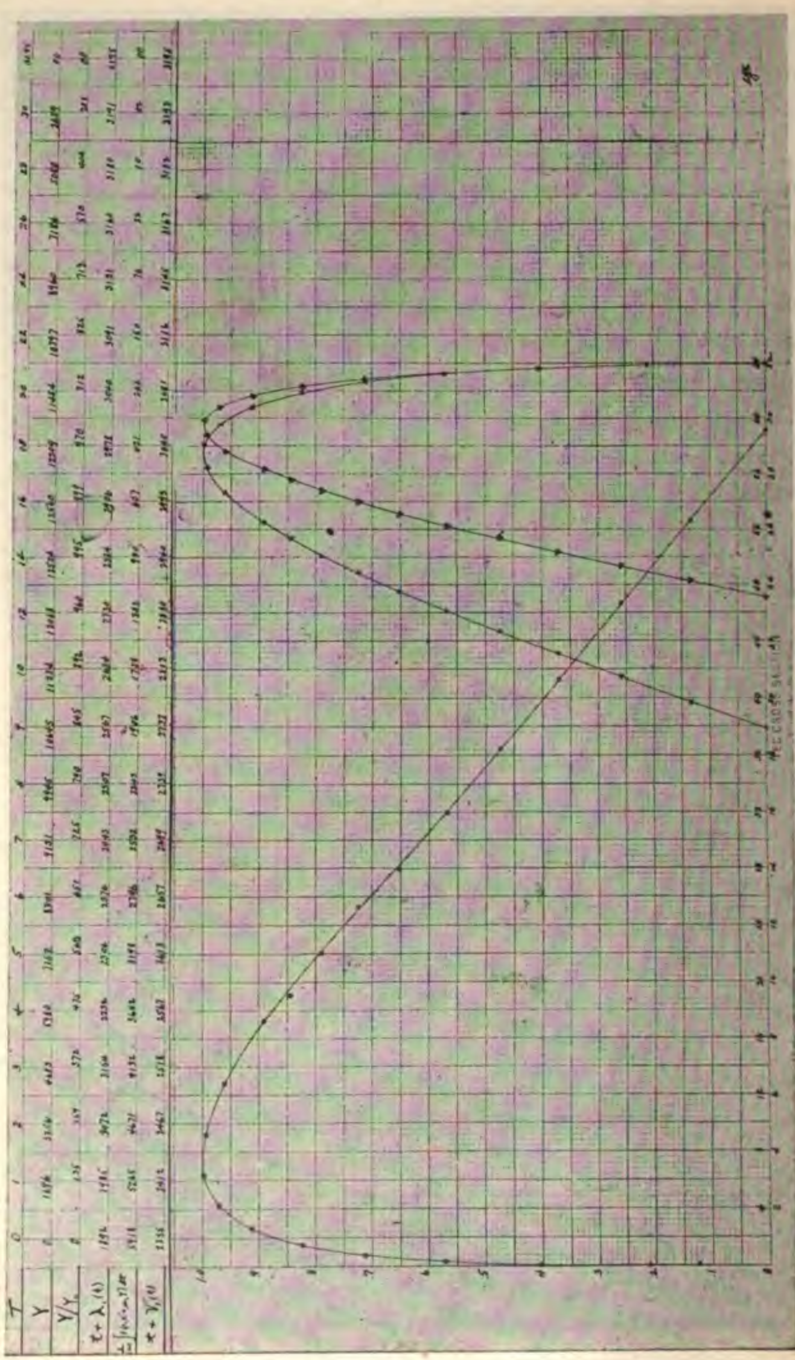


FIG. 4.

convenience in handling these different effects, each is expressed in terms of its percentage of the unit effect acting throughout the entire trajectory. By plotting these ratios in percentages against the ratio of ordinates, $\frac{Y}{Y_0}$, the "weighting-factor" curves are

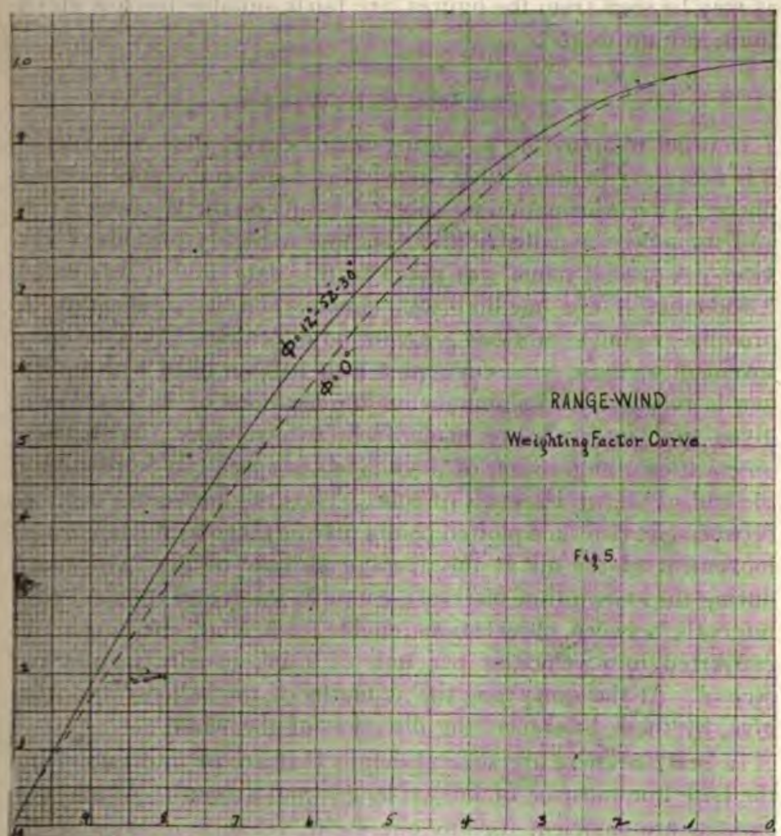


FIG. 5.

drawn. It should be noted that weighting-factor curves are necessary because the effects of the different disturbances acting through only a part of the trajectory are not directly proportional to the time.

Thus, Fig. 5 is the weighting-factor curve for the range-wind. Fig. 6 is the weighting-factor curve for the cross-wind component.

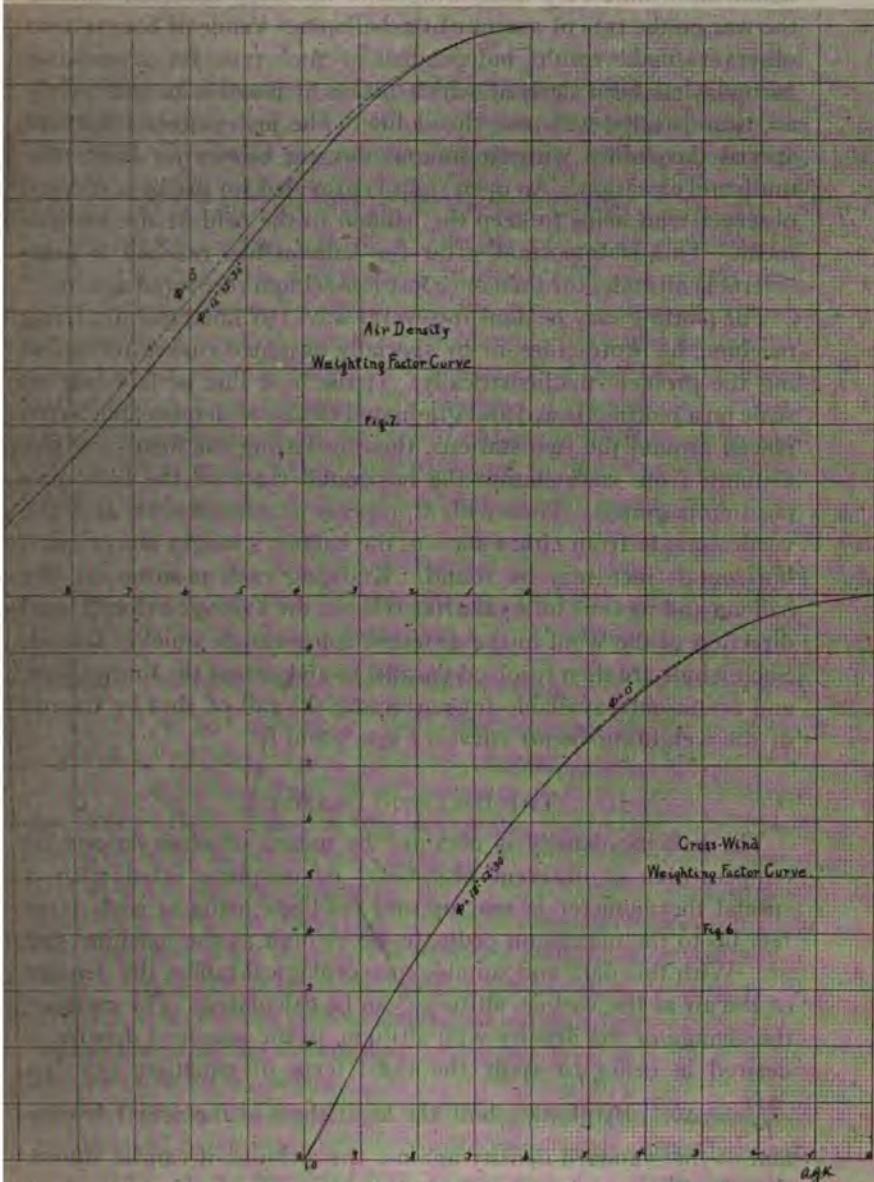
Fig. 7 is the weighting-factor curve for the density or a change in the ballistic coefficient.

The dotted line curve in each of these figures is the limiting curve approached by each particular curve as the elevation approaches zero. Such limiting curves are readily constructed and, as may be seen from the figures, are fairly suitable for low elevations, say up to 10°.

THE BALLISTIC WIND

In order to apply the weighting-factor curves thus constructed, it is necessary to know what the wind is doing in the upper atmosphere. This information was obtained daily on the Western Front and its source and distribution became a highly organized service. A special name was given to this data, and it was called "Sondage." The method was simple, and its application to proving ground conditions presents no difficulties. For the measurement of these wind-currents a little balloon filled with hydrogen is released, and simultaneous observations of its position at given time intervals are made from two stations. With these observations the position of the balloon in space can be plotted at the end of known intervals of time. Thus the horizontal distance between any two such plotted points may be taken as the horizontal movement of the air at the average altitude of the two points, during the known time interval. Suitable scales and constant time intervals between observations enable such wind currents to be converted into velocities per unit of time, usually meters per second. At the same time the azimuths of the balloon's position give, by their difference, the direction of the wind.

In practice there are several details that are of interest. First the base line must be of known length and azimuth. While two stations are sufficient for any one flight, yet their location at the corners of an equilateral triangle, if possible, will be convenient and will eliminate the case of a surface wind blowing directly towards one observer. Telephone communication allows simultaneous readings at constant time intervals. One station is the "master" and shall be the point of release of the balloon, or the "origin." The balloons are of thin rubber and colored either red or white. When empty they are of either 6-inch or 9-inch radius. They are inflated by hydrogen until the proper "free lift" is


Air Density
Weighting Factor Curve
Fig. 7
Cross-Wind
Weighting Factor Curve.
Fig. 6

FIGS. 6 AND 7.

obtained. Some very interesting data has been collected during the war on the rate of ascent of the balloons. While of course two observers make results independent of such rate, yet a working formula has been derived which makes it possible to get fairly accurate results, with one theodolite. The instruments used are special theodolites with continuous tangent screws for both azimuth and elevation. An open sight is provided for use by a second observer who helps to keep the balloon in the field of the instrument. This is important after the balloon has reached a considerable altitude, for then once lost it is seldom recovered again.

The plotting may be done in several ways: by universal drafting machine, by protractors, or by specially designed curves for solving the problem mathematically. If the base line be laid out to scale on a plotting board and graduated circles with moveable arms placed around the two stations, then by setting the arms for the azimuth from each station the horizontal trace of the balloon's position is gotten. Then with a properly graduated scale and the vertical angle from either station, the balloon's height above such horizontal trace may be found. Knowing each position of the balloon and its time interval after release, the average velocity and direction of the wind in the different zones can be quickly found. Such winds are then resolved parallel to and across the line of fire, and are at once available for correcting the fall of shot by means of the weighting-factor curves, Figs. 5 and 6.

THE BALLISTIC DENSITY

The ballistic density is obtained by means of observations of temperatures at different altitudes. An airplane fitted with a special thermometer is sent up and readings made at each 1000 feet up to the maximum ordinate, or as high as the machine can go. With this data and suitable meteorological tables, the density of the air at the various altitudes can be calculated. The ratio of the change of the density with altitude, to the standard density is desired in order to apply the third term of equation (1); or $\frac{\Delta H}{H} = \Delta Y$. By plotting both the logarithms of the actual density and of the standard density against the altitude, it can be shown that the difference between the two curves multiplied by a constant will give the value of ΔY. Then by plotting an auxiliary curve with values of ΔY as ordinates and Y as abscissæ, the ratio of the

change of density to the standard density for all altitudes can be gotten. This curve is applicable to all guns firing during the time of day for which the curve holds true. For any zone the value of ΔY can be obtained, and is then multiplied by its proper weighting factor for that zone, as shown in Fig. 7. And the sum of the products gives the percentage variation by which to multiply $\frac{1}{100}\int_T^t F(X'\lambda_1+\mu_1 Y')\,dt$ to give the change in range.

Before proceeding with the application of the weighting-factor curves, it should be said that the ballistic wind and density may be determined several times during the day. At proving grounds guns are not fired on elevations which will give a maximum ordinate greater than the height to which balloons have been observed or airplanes have ascended. In practice in the field it has been found possible to extend the plot of either the balloons or the airplane observations, by extrapolation and formulæ, to a considerable distance above the highest observation, with acceptable results.

THE APPLICATION

The proving ground use of the method above described is mainly to provide suitable data from which to construct range tables. Suppose that it is desired to extend the range table for a $\frac{16''}{45}$ gun from 15° to 40° elevation. With the best possible value of the coefficient of form from previous rangings, the given muzzle velocity, and an elevation of 20°, compute the trajectory by short-arc integration. Compute the differential corrections and draw the weighting-factor curves. Send up pilot balloons and airplanes for ballistic wind and density, just before firing. Then fire at least 5 rounds on 20° elevation, and make ranging observations. If the computed range is grossly at variance with the observed range, then a serious error has been made in the assumed value of i. A new trajectory must then be computed using a more appropriate value of i; and the differential corrections and weighting-factor curves must be recomputed. With these weighting-factor curves and the differential corrections, the observed ranges are corrected to standard conditions; that is, to the range with an undisturbed trajectory. Since the third term of equation (1) gives the value of ΔR due to a variation of one per cent in either the density of the air or the ballistic coefficient, the difference between the cor-

rected range and the calculated range divided by the value of this term, that is $\frac{1}{100}\int_T^t F(X'\lambda_1+\mu_1 Y')\,dt$, will give the percentage correction to apply to the assumed coefficient of form. Again, if the corrected value of i thus found is materially different from that used in the short-arc integrations, a new computation must be made.

Proceeding in this way, a series of corrected ranges for all values of ϕ will be obtained. Now it will be recalled that in the beginning the value of the ballistic coefficient was defined by the equation

$$C=\frac{w}{id^2}.$$

But in using the Siacci method the ballistic coefficient is

$$C=f_a\frac{w}{id^2}\,\frac{\delta_1}{\delta}.$$

In considering this expression, it should be noted that

(1) for range table computations, the $\frac{\delta_1}{\delta}$ term is unity as conditions are taken as standard;

(2) the value of i has been corrected by the term

$$\frac{1}{100}\int_T^t F(X'\lambda_1+\mu_1 Y')\,dt;$$

and incidentally that i is apparently an inverse function of the velocity;

(3) the fa term is unknown and only approximated by Alger and Ingalls;

(4) the β term is likewise only approximated; and

(5) an accurate numerical value for $\frac{f_a}{\beta}$, or $\frac{\beta}{f_a}$, is all that is needed to apply Siacci correctly, for the given elevation.

Consequently, knowing the angle of departure, the muzzle velocity and the corrected range, the ballistic coefficient can be computed. The value of C thus obtained may be further broken up and a numerical evaluation obtained for the term $\frac{\beta i}{f_a}$ or $\frac{\beta}{f_a}$ for each elevation may be found. By plotting these values against the elevation, a curve for computing range tables by the old Siacci method can be readily constructed.

It will thus be appreciated that for range-table computation the method herein described permits the relatively quicker Siacci method to be used, and that by the addition of the curve of $\frac{\beta i}{f_a}$ against ϕ the results are then freed of the errors analyzed so ably by Captain Eggert.

In conclusion, it may be said that several refinements have been omitted entirely, and that no discussion of the actual derivation of the G and H tables has been attempted. Further, if the method given for handling the altitude factor, fa, is not agreed in, it may be stated that a new equation for evaluating it has recently been developed, which allows a computation of βi independently of the altitude-factor.

It would also be unfair to the originators of the method not to say that its flexibility permits of considerable modification of the basic tables and the introduction of new ones, as experimental work in exterior ballistics continues.

In general, it would seem unwise to attempt any long-range firings for range-table data without using this, or a similar method to compensate for the variations of both wind and density with increasing altitudes. It is not deemed probable that the method has any direct application to shipboard conditions.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ELECTRIC PLANT OF THE BATTLESHIP *TENNESSEE*

By ENSIGN R. L. WEBER, U. S. N. (T)

Purpose.—It is intended to describe the electric plant of a battleship and, because of the fact that it embodies the highest developments to date and marks another step in the adoption of electric propelling machinery, the particular plant of the battleship *Tennessee* is chosen for illustration.

Scope.—The scope of this paper must necessarily be limited by the scarcity of dependable data available and limitations of space practically confine the discussion to the ship's propelling machinery. This is, at once, the most interesting and the only part for which data is now at hand.

Increase in Use of Electricity Aboard Ship.—The marked increase in the use of electricity aboard ship is worthy of mention. While the development has been contemporary with the increase in size of ships, it is not believed that the size factor alone has been responsible for this development.

The increase aboard ship has followed closely a similar increase ashore and, while the naval progress has not quite satisfied the more ardent advocates of electric propulsion, our navy is, nevertheless, in the vanguard, in fact, leading the world in this radical step forward.

For auxiliary and miscellaneous uses, the capacity of generators installed per ship has increased from about 100 kilowatts in the 90's to about 1200 kilowatts in 1916; and now comes the jump from 14,000 kilowatts in the first electrically propelled battleships to the proposal of 150,000 kilowatts for the new battle cruisers.

The magnitude of such a proposal and its bearing on the particular subject under discussion warrants a review of the factors justifying the selection of this type of drive.

Type of Drive Comparatively Recent.—Active discussion of electric ship propulsion did not start until about ten years ago and real development was slow until about five years ago. The subject has been one of considerable argument and little has been taken for granted. Before the adoption of electric battleship propulsion there was an experience with about 12,000,000 horsepower of marine turbines, 3,000,000 horsepower of which were geared installations, so that the electric drive had the inertia of considerable precedent to overcome.

Factors Affecting Choice of Drive.—The choice of this type of drive appears most logical in ships of over 5000 horsepower, with especial advantages for battleships or other very large fighting ships. Approximately in their order of importance, the following factors have been considered in the adoption of type of drive:

1. Reliability,
2. Maneuvering qualities,
3. Economy,
4. Space occupied,
5. Weight,
6. Care and upkeep.

Reliability.—No serious question has been raised as to the mechanical reliability of the individual parts of the system, the discussion centering on the hazards of control and operating cables and the action of water on the electrical apparatus. As, obviously, these hazards can be easily insured against to any reasonable degree desired, the advantages of the electric drive as regards reliability may be pointed out.

Greater reliability is attained owing to the facility with which power may be shifted between generators and motors, the installations being practically duplicates throughout. For instance, the breaking down of one turbine does not materially affect the ship, except at high speeds, say above 17 or 18 knots.

Difficulties with auxiliaries often affect operation and output as seriously as trouble directly with the main units. The flexibility of this drive and the ease with which load from all propellers can be shifted to the other main unit gives it a further advantage.

Since the permanent advent of the turbine in marine practice, the elimination of considerable blade trouble may be expected.

The blade distortion, occurring nearly always during backing, will not occur with the electric drive in which the main units are always turning in the same direction.

The elimination of racing further increases the reliability of this system.

Maneuvering Qualities.—Very superior maneuvering qualities are claimed. The control is well centralized and the operation of light parts only is necessary. The speed can be very accurately adjusted and maintained without undue effort on the part of the operators. This advantage is strikingly evident during heavy seas, when the prevention of propeller racing is automatic, being electrically under governor control, thereby eliminating mental strain on the operator and physical strain on the equipment.

Full power can be obtained astern and, as this is accomplished without reversing the main generators, the electric drive has, in this particular, a big advantage over the geared turbine installation.

While much greater rapidity of operation is claimed for this form of propulsion, it is thought wise to defer opinion in this regard pending further experience in more difficult service.

Economy.—Claims of great superiority of economy have been the subject of lively dispute, 20 to 30 per cent in favor of the electric drive and against reciprocating engines and direct-connected turbines being claimed. It is reasonably certain, however, that for a battleship where economy at two speeds, cruising and full, is necessary, the electric drive is considerably superior to the reciprocating and direct-connected turbine systems; and, at cruising speed is also superior to geared turbines. As most of the steaming is done at cruising speed, this is an important advantage. The table below shows comparative water rates at various speeds for all the types except geared turbines, data for which has not been found.

		Pounds Steam per Effective Horse-power per Hour at				Prop. Speed
Ship	Type	12 knots	15 knots	19 knots	21 knots	at 21 knots
Florida	Parsons Turb.	31.8		24.0	23.0	328
Utah	Parsons Turb.	28.7		20.3	21.0	323
Delaware	Recipro. Eng.	22.0		18.7	21.0	122
California	Elec. Drive	17.3	15.2	15.0	16.4	175

The steam consumption of the *Tennessee* is shown graphically on Fig. 1.

Inherent advantages of the electric drive over the geared turbine are that the former uses only one turbine at low powers and has the double motor winding, the equivalent of two gear ratios. Not only does this permit of more efficient speeds for the turbines but it eliminates some of the element of compromise in the propeller. The handicap of the geared turbine with only one speed reduction is evident.

The turbines not only operate at more favorable speed but, also, more favorable load conditions, as at low speeds only one turbine is used, so that the load will always be twice that on direct-connected machinery.

The larger number of turbines and the friction and windage losses of the astern turbines incur further losses in the other types of drive, but these are not so large as the other factors above mentioned.

Space Occupied.—While the electric drive probably has little or no advantage over the geared turbine in the amount of space occupied (except for very large and high powered ships), the flexibility of arrangement has not only permitted highly desirable changes in the hull design to be made, with more effective use of space, but, military advantages of considerable weight have accrued to this type.

Weight.—The electric drive is probably heavier than geared turbines in the smaller sizes but for the largest ships now contemplated, the balance probably shifts.

Care and Upkeep.—These are related to reliability and the best of records have been made by ships with this drive. The high speed turbines, having smaller dimensions, are easily handled and repairs to turbine rotors have been made by the ships mechanics. As one engine room would be idle practically all the time, the engine room watch can be considerably reduced if not cut in two. A further advantage arises from the possibility of overhaul of one of the turbines, while still maintaining 17 to 18 knots.

It must not be assumed from the above favorable statements that the case of the electric drive affords no rebuttal, but, as this has been ably handled by its opponents, the newer drive will probably need all the support it can accumulate. There has been

no attempt in the foregoing review to color the case and in many instances the claims set forth are much more conservative than those of its ardent supporters.

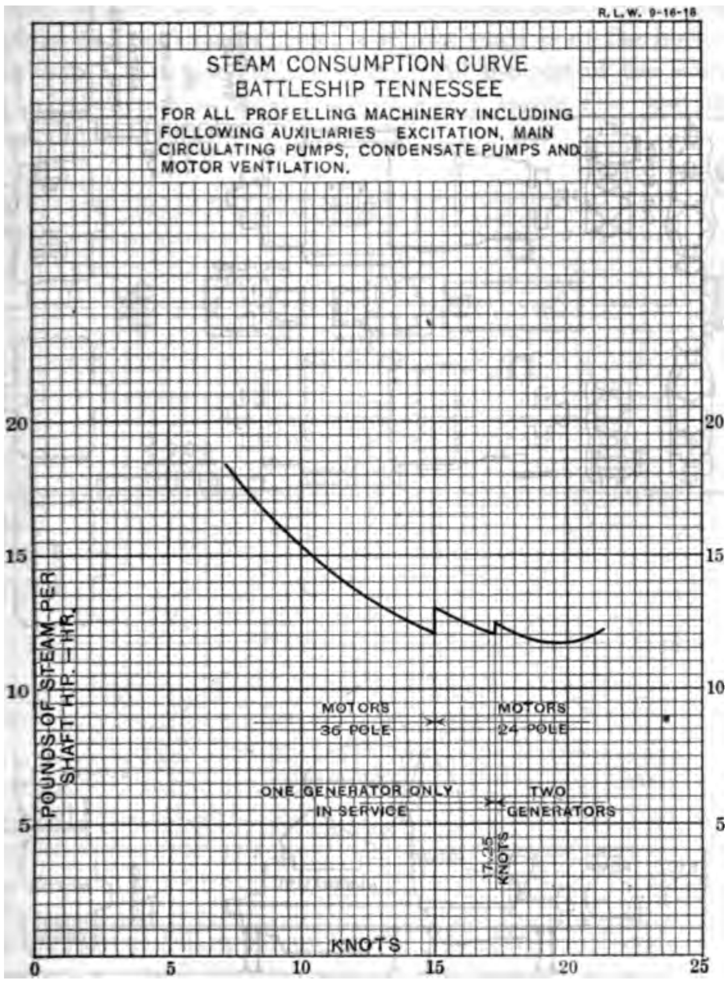


FIG. 1.

The Ship.—As affecting the electrical plant it is probably sufficent to state that she is one of the most powerful battleships now authorized or under construction, displacing 32,000 tons and having a speed of 21 knots at full power.

Reprints of Articles The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., JULY 15, 1919.

INFORMATION INDEX

total of 38 warships. These vessels will form the nucleus of the after-the-war French naval force, but during the period that will last until peace is signed with Austria and Bulgaria certain forces will be maintained in specific localities.—*N. Y. Times*, 7/10.

ENEMY SHIPS ALLOCATED TO FRANCE.—Under the terms of the armistice, 113 enemy ships of 505,906 gross tons have been allocated to France for operation. This assigned fleet is made up of 100 German ships of 461,185 tons and 13 Austrian ships of 44,721 tons.—*The Nautical Gazette*, 6/28.

GERMANY

GERMAN NAVAL LOSSES.—The Peace Treaty having been signed, the German passion for statistics will probably manifest itself in giving the nation's casualties in the war with a fair degree of accuracy. It may be said, indeed, that during the first two years of the struggle the Germans vied with the British in publishing regularly their army losses. France concealed hers for reasons of policy; those of Russia were always in round numbers and obviously inflated; while the Italians and Austrians gave little attention to their casualty lists, not caring to make damaging admissions. Germany's naval losses as now published in the *Vossische Zeitung* of Berlin are declared to be complete and authoritative and are so accepted in Washington.

The list of ships sunk and destroyed differs from previous estimates, which were more or less conjecture, in including a large and not a small number of destroyers. At the close of last year the number of destroyers supposed to have been lost by Germany was less than twenty, but the official report, as printed in the Berlin newspaper, makes the total forty-nine. It is now admitted—perhaps confessed would be the apt word—that 178 U-boats were lost in service, 82 of them in the North Sea and the Atlantic, 72 "off the coast of Flanders," 16 in the Mediterranean, 5 in the Black Sea, and 3 in the Baltic. Fourteen submarines were blown up by their own crews and seven interned in neutral harbors. Before the armistice Berlin always denied with a show of sticking closely to facts the occasional British Admiralty reports that the Allies were dispatching a good many U-boats, and when Mr. Lloyd George ventured to be explicit he was ridiculed.

The Germans lost few of their big ships. They say now, as they have always declared, that but one battleship, the *Pommern* of 13,200 tons, was sunk during the war; also one battle cruiser of 26,000 tons, the *Lützow*, both in the sea fight off Jutland. The British added to this list, but apparently only from observation of crippled ships. There is no reason now to believe that most of them failed to reach harbor shelter. They had a whole night, during which they were not molested, to stagger away to their base. In ships not of the first line of battle the Germans sustained considerable losses—6 older armored cruisers, 8 modern small cruisers of the latest design, and 10 smaller cruisers of the old type, besides 20 large and 41 small torpedo boats, 9 auxiliary cruisers, of which the largest were the *Cap Trafalgar* of 20,000 tons and the *Kaiser Wilhelm der Grosse* of 21,000 tons, 28 mine-sweepers, and 122 trawlers and patrol vessels. The number of warships of all kinds lost was 490. As Germany's naval warfare was for the most part defensive, aggressive only by stealth or when a raid was attempted, the conclusion must be that the British, the most active of the Allies, were very much on the alert to attack the enemy when he showed himself.

Germany's losses of men killed in the naval service are now reported to have been 29,685, but 10,625 of these were marines. As marine contingents were used in the field on the western front, it seems to be a question whether the marine casualties given in this report can all be charged to the sea service. When Great Britain announced in an Admiralty report of November 26 last that her naval casualties had been 39,766—officers killed

or died of wounds 2466 and men 30,895, officers wounded, missing, or prisoners 1042 and men 5363—it meant that these losses were all incurred by the navy. To this total should be added 14,661 officers and men of British merchant ships and fishing craft who lost their lives, and 3295 who were taken prisoners in the submarine warfare of the enemy. It seems probable that the Germans killed in actual sea warfare were considerably less than one-half of the British total.—*N. Y. Times*, 7/10.

GERMAN NAVY AS INTENDED, AND AS IT IS.—According to the German Navy Law Amendment Act of 1912, the fleet to be fully commissioned in 1919 included 25 dreadnoughts, 9 battle cruisers, 4 pre-dreadnoughts, 21 light cruisers, 99 destroyers, and 54 submarines—an active personnel of 100,000 and a reserve of 80,000. The actual strength in fully commissioned ships in 1919 according to the Peace Treaty consists of 6 pre-dreadnoughts, 6 light cruisers, 12 destroyers, and 12 torpedo boats, with a personnel of 15,000 and no reserves.—*Scientific American*, 7/5.

GERMANS SINK THEIR FLEET.—The German fleet interned at Scapa Flow, north of Scotland, was valued at $350,000,000. The ships were unarmed, but manned by skeleton crews of Germans. At noon on Saturday, June 21, these crews opened the sea-cocks and took to the boats, with the result that all the battleships and battle cruisers except the *Baden*, and most of the destroyers, went to the bottom. Admiral Reuter, according to a London dispatch, had been allowed to visit Germany a few weeks ago, on the pretext of ill health, but returned in time to supervise the sinking of the fleet.

The sinking was accomplished while the main British fleet was absent, and only a few destroyers and small craft were in the harbor. The German ships went to the bottom with their battle flags flying, their crews taking to their small boats and cheering.

Of the 74 interned German war vessels at Scapa Flow, 6 were battle cruisers, 10 were battleships, 50 were destroyers and 8 light cruisers, of which 2 were mine layers. The battleships are the *Kaiser, Kaiserin, Koenig Albert, Bayern, Markgraf, Kronprinz Wilhelm, Prinz Regent Luitpold, Grosser Kuerfuerst* and the *Friedrich der Grosse*, averaging about 25,000 tons each. The battle cruisers are the *Seydlitz, Hindenburg, Moltke, Von der Tann* and *Derflinger*. These vessels were all built between 1906 and 1914. The nine battleships cost $89,000,000, the five battle cruisers $75,000,000, and the eight light cruisers cost $12,200,000.

There were no submarines involved in the sinking. The submarines turned over by Germany to the Allies and the United States were all surrendered completely under the terms of the armistice as signed on November 11 last. None of these submarines was at Scapa Flow. They are interned at Harwich, England. As their surrender to Admiral Beatty of the British grand fleet was complete, they were turned over absolutely, and no German caretakers were left on board. But under Article 23 of the armistice, 74 other war vessels were designated by the Allies and the United States for disarmament and internment in neutral or allied ports. The vessels were sent to Scapa Flow, where, under the terms of the armistice, "they will remain under the suprvision of the Allies and of the United States, only caretakers being left on board."

The depth of water at Scapa Flow varies from 78 to 114 feet, and some of the larger German ships may have to be blown up or raised to clear the harbor.

The British Admiralty forwarded a full report of the sinking at Scapa Flow to the Naval Armistice Commission in Paris, by whom the next steps will be directed. "It is up to Paris—we did not make the terms for internment," a high official of the Admiralty is quoted as saying. "Von Reuter broke his parole and should be tried accordingly by an international court. I do not think that France or the other Allies have cause to grieve, as the ships were left in such a state as to be nearly valueless."

Admiral Freemantle, British commander at Scapa Flow, where the interned German fleet was sunk by its crews, according to a cable has informed Admiral von Reuter and the German staff they will be held as prisoners of war for "violation of the armistice by a traitorous act."

The representatives of the Allied Powers sitting at Paris sent a note to the representatives of Germany at Berlin on June 26 in reference to the sinking of the German fleet. The note declared that "the sinking of the ships constituted at once a violation of the armistice, and an act of gross bad faith toward the Allied and Associated Powers," and that it "can only be regarded as a deliberate breach in advance of the conditions of peace." The same was also stated to be true of the burning of the French battle flags in Germany. "It is evident," the note says, "that any repetition of acts like these must have a very unfortunate effect upon the future operation of the treaty which the Germans are about to sign." Notice was given that the Allies would demand reparation for the sinking, and trial of those responsible.—*Army and Navy Journal*, 6/28.

GERMANY'S COMMERCE RAIDERS.—It has hitherto been very difficult to obtain particulars of the German merchant vessels which, during the war, caused such great damage to the Entente's Mercantile Marine, according to the *Nationaltidende*. As the German Censor's office now no longer places obstacles in the way of publicity, the German press reports certain merchant vessels which, under other names, have rendered service as auxiliary cruisers.

On the return of the raiding vessel *Wolf* in February, 1918, it was announced that this vessel was formerly the Bremen steamer *Wachtfels*. The famous raider *Moewe* was the Hamburg steamer *Pungo*, owned by F. Laeisz. She was built shortly before the war for the conveyance of bananas from West Africa, and was fitted with unusually powerful engines, which gave her a speed of about 16 knots. This speed on various occasions saved the *Moewe* during critical situations.

The British steamer *Yarrowdale*, captured by the *Moewe* and taken to Swinemunde in 1916, was converted into a raiding vessel, and rendered service under the name of *Leopard*. She went to sea at the beginning of March, 1917, and nothing was heard of her until a message was picked up in a bottle reporting that she had been destroyed by English warships.

A similar fate overtook the raider *Greif*, which was formerly named *Guben* and belonged to the Deutsch-Australische Dampschiffs Gesellschaft. She was 4900 tons gross and was destroyed at the end of February, 1916.

There may also be mentioned the raiding vessel *Wolf I*, which was formerly called the *Belgravia*, and belonged to the Hamburg-Amerika Ligne. She was 6648 tons gross and had a speed of 12 knots. After taking in a cargo of mines, she left Cuxhaven in February, 1916, but stranded the following day at the mouth of the Elbe and was badly damaged. The vessel was refloated and taken to Hamburg, where she had to undergo extensive repairs. She did not go to sea again.

It is well known that the auxiliary cruiser *Berlin* had to put into Trondhjem in November, 1914, where she was interned. What was not known before is that it was this Norddeutscher Lloyd steamer which laid mines off the West Coast of Ireland and Scotland, to which the English dreadnought *Audacious*, among others, fell a victim.—*Shipping*, 6/21.

HUNS READY FOR BIG NAVAL STROKE WHEN SEAMEN MUTINIED.—"I rejoice over the sinking of the German fleet in Scapa Flow," is the statement made to me by Admiral Scheer, formerly commander-in-chief of the German high seas fleet. "I am very happy for two reasons. The first is that the fleet was prevented from falling permanently into the hands of the British. It would have been painful for our good ships, after sailing the seas for years, to come under enemy flags. This humiliating and painful sight is now spared us by the brave deed in Scapa Flow. The second reason

I rejoice is that the stain of surrender has been wiped from the escutcheon of the German fleet.

"The sinking of the ships has proved that the spirit of the fleet is not dead. This last act was true to the best traditions of the German Navy. This deed was spontaneous and, I am convinced, it was not ordered nor inspired from Berlin. Our seamen were unwilling to bear the final disgrace or to suffer that the ships be turned over to the British. More than this, the spirit of Scapa Flow points the significant moral that our seamen, once removed from evil propaganda influences and left to come to their senses, again became mindful of their 'military honor.'

"The terms of peace brought the men of our fleet to the realization, unfortunately too late, that they had been misled, hoodwinked and deceived. Subtle revolutionary propaganda had persuaded the men of our fleet that they could end the war quickly by going on strike. They were told and they believed, that if they struck the seamen of the enemy fleets would revolt also and that the war would thus be brought to an end automatically. In this misguided belief they started a revolution. Too credulous, they made the mistake of not waiting to let the other fellow strike first.

"It was never our intention to send the high sea fleet out to its certain death. At the beginning of the outbreak of the November revolt we were on the eve of undertaking a naval operation from which we promised ourselves the utmost success. This operation, after nearly two years had, at last, been made possible by the discontinuance of our submarine warfare during the negotiations leading up to the armistice. For nearly two years we had been unable to undertake an operation on a large scale with the high seas fleet. This, first, because the fleet was essential to protect the base of submarine warfare; second, because while our submarine warfare was carried on, we lacked all strategic flank protection for long distance naval operations.

"Our fleet attack would proceed only from the narrow 'Wettriangle' behind Helgoland. To this base alone we were always forced to return.

"An operation of our high seas fleet against any point on the British coast left both our flanks exposed. The battle of Jutland proved we were not afraid of encountering the British grand fleet on a fair field. But even if we had succeeded in drawing out the British grand fleet and beating it, we always had to figure on the danger of being cut off on our way home because, no matter how victorious we were, some of our ships would inevitably bring home holes in their body.

"In an operation against the British coast our strategic left flank was always exposed to the attack of British naval forces coming from the channel and our right flank to attack from the north. With the suspension of our submarine warfare, this unfavorable strategic situation was suddenly changed. We now had plenty of submarines to use for the flank protection of our high seas fleet in any possible operation. With our hands thus freed we decided at the beginning of November that our fleet should and could strike a hard, perhaps a decisive, blow. We decided that while our armies were stubbornly and heroically resisting in the west, our fleet should not remain idle.

"Our plans offered every chance of success, but I was not one to send the high seas fleet out to its death, but to attack the coast of England in the direction of the mouth of the Thames to give us battle, in which case the grand fleet would have run into our flanking submarines.

"Our plan was carefully worked out and offered the certainty of success if the grand fleet came out. The one chance of failure, we figured, was that the British fleet might not be coaxed out by our Channel attack. This plan, naturally, could not be disclosed to the men of our fleet. From preparations for this operation they got the fatal idea into their propaganda-turned heads that the fleet was about to be sent out to its death.

They argued, 'Why should we die on the verge of peace and with negotiations for an armistice going on?'

"In this misguided frame of mind they mutinied and started the revolution which they have since come to regret bitterly. They thought they were doing right and that their action would secure a just and equitable peace for the Fatherland. They still thought so when they took the ships over to Scapa Flow to be interned.

"I am convinced that not an officer or man would have been willing to take the ships over to Scapa Flow if they had known the peace ultimately to be imposed. And there is nothing to the charge of cowardice that officers and men should have gone down fighting rather than surrender the ships. They all thought they were doing a high patriotic duty in taking the ships over to be interned and that by helping to execute this term of the armistice they were making possible a fair peace that had been promised them. Removed from propaganda influence, they realized what they had done and they atoned for it by sinking the fleet. Not for decades will Germany have a fleet again.

"If Great Britain increases its naval armament in the future, such an increase can be directed only against its allies, America or Japan; because Great Britain to-day has no other naval rivals than the two nations I have mentioned. Germany's navy is gone. France's navy never did amount to anything."

Admiral Scheer made the remarkable statement to me that Great Britain could have ended the war quickly in its early stage by a bold, naval offensive in the spirit of Nelson.

"Right up to the last moment we did not expect England to enter the war," Admiral Scheer said. "Accordingly, we were not prepared against a naval attack by Great Britain. We were prepared only for a two-front war; accordingly the third front, our sea front, was denuded of military forces. If the British fleet had attacked in the first week of the war we should have been beaten. Under cover of the British Navy, the Russian armies, then available in great numbers, could have landed on the coast of Pomerania and could have easily marched to Berlin.

"I believe the British fleet did not attack in the first weeks of the war because Great Britain did not want to pay the price of a victory. She hoped to keep her fleet intact for pressure on the Peace Conference, and she thought it wiser to let the French and Russians win the war on land. Admiral Jellicoe's slow blockade strategy was correct and accomplished its purpose. No fault can be found with it provided that his confining the fleet to a blockade can be reconciled with conditions in the British Navy.

"I suspect also that there were no plans prepared at the beginning of the war for joint operations by the British, French and Russian fleets. I believe also that the British fleet was not used for attack early in the war because nobody at that time knew just what would be the effect of torpedoes and mines in actual practice, and Admiral Jellicoe thought best to lay off. Where I find fault with Jellicoe is that he imputes that we, in a far less favorable strategic position, should have done what he hesitated to do with the advantage of position and superior forces."—*Baltimore Sun*, 6/30.

THE PEACE TREATY AND GERMAN AVIATION.—In glancing over the official summary of the Peace Treaty, one finds the following rulings with regard to German aerial activities: The air clauses provide that the armed forces of Germany must not include any military or naval air forces. Germany is, however, to be allowed to maintain a maximum of 100 unarmed seaplanes up to October 1, 1919, to be exclusively employed in searching for submarine mines. The entire personnel of the air forces in Germany is to be demobilized within two months, excepting for a total of 1000 men, including officers, which may be retained up to October. The aircraft of the Allied and Associated Powers are to enjoy full liberty of passage and

landing over and in the territory and territorial waters of Germany until January 1, 1923, unless prior to that date Germany is admitted to the League of Nations or is permitted to adhere to the International Air Convention. The manufacture of aircraft and parts of aircraft is forbidden throughout Germany for six months. All military and naval aircraft (including dirigibles) and aeronautical material are to be delivered to the Allied and Associated Governments within three months, except for the 100 seaplanes already specified. General articles provide for the modification of German laws in conformity with the preceding clauses. All the clauses contained in the Treaty are to be executed by Germany under the control of the inter-Allied Commissions, to be specially appointed by the Allied and Associated Governments for which the German Government is bound to furnish all necessary facilities and expenses of upkeep. The duties of the Military, Naval, and Aeronautical Commissions of Control are laid down in detail. Aircraft of the Allied and Associated Powers shall have full liberty of passage and landing over and in German territory, equal treatment with German planes as to use of German airdromes, and with most-favored-nation planes as to internal commercial traffic in Germany. Germany agrees to accept Allied certificates of nationality, airworthiness, or competency and licenses, and to apply the convention relative to Aerial Navigation concluded between the Allied and Associated Powers to her own aircraft over her own territory. These rules apply until 1923, unless Germany has previously been admitted to the League of Nations or to the above convention.—*Scientific American*, 6/21.

SUBSTITUTE LUBRICANTS FOR LOCOMOTIVES AND WAGONS.—Owing to the scarcity of mineral lubricating oils in Germany during the war, recourse had to be had to substitutes, one of the most satisfactory being a mixture of mineral oil and tar oil. For summer use, the mixture consisted of 80 parts tar oil and 20 of mineral oil, stirred together at a temperature of 80° C. For the winter months the proportions were altered to 50-50, with an addition of 8-15 per cent of petroleum in the very cold weather. The mixing apparatus consisted of a simple framework of timber supporting the two casks of oil discharging into the feeding hopper of the mixer. The latter was a horizontal cylinder, holding 5 cwt., and provided with paddles and a steam coil, and the mixing took only a few minutes. The winter oil had the following characteristics: Sp. gr. at 20° C., 0.976; flash point, 150° C.; burning point, 180° C.; viscosity at 20° C., 50.94. The mixing and warming facilitated the deposition of the carbon suspended in the tar oil, thus preventing the premature choking of the wicks.—*Technical Supplement to the Review of the Foreign Press*, 6/10.

GREAT BRITAIN

DISTRIBUTION OF THE FLEET.—In his speech on the Navy Estimates, Mr. Walter Long briefly described the measures which the Admiralty was taking to show the flag in every part of the world. He added that the worthy representation of British sea power abroad meant everything to the British Commonwealth, its prestige, greatness, and trade. Since that date the Admiralty's plans for the distribution of the fleet at home and abroad have been completed and made public. The fully commissioned force in home waters is to consist of three battle squadrons, the First, Second, and Third, and one battle cruiser squadron, with Admiral Sir Chas. E. Madden in supreme command. The First and Second Squadrons, made up of the ten ships belonging to the *Queen Elizabeth* and *Royal Sovereign* classes, represent the Atlantic fleet, in which is incorporated the Battle Cruiser Squadron, a "Flying Squadron" of seaplane carriers, the First Light Cruiser Squadron, and several flotillas of destroyers and submarines. The Third Battle Squadron and the Second Light Cruiser Squadron represent the home fleet. A striking feature of these

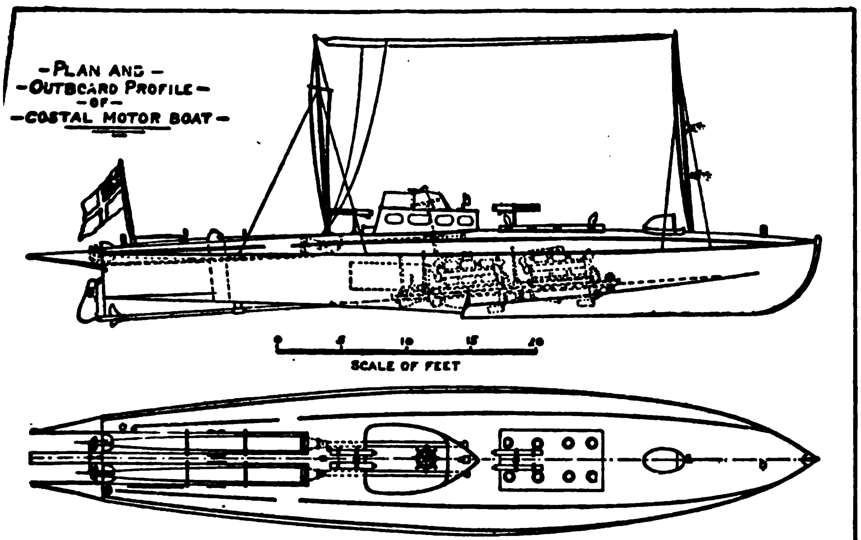
formations is their homogeneity, a principle which has been extended to the fleets and squadrons detailed for service abroad. The heavy guns mounted in the Atlantic fleet are ninety-two 15-inch and twenty-four 13.5-inch; in the home fleet sixty 13.5-inch. These figures include the artillery of the Battle Cruiser Squadron, consisting of *Lion, Princess Royal, Tiger, Renown,* and *Repulse.* The First Light Cruiser Squadron is made up of three vessels of the *C* and three of the *D* class, but when ships now completing are delivered it will consist of six *D* cruisers. The Flying Squadron—a designation which now has a significance more literal than formerly—is composed of *Furious, Argus, Vindictive* (ex-*Cavendish*), and *Vindex,* the latter a converted merchantman. In the Mediterranean is the fourth battle squadron of six ships, viz., four *Iron Dukes* and two of the *King George V* class; the Third Light Cruiser Squadron of six *C* cruisers; the Sixth Destroyer Flotilla led by the *Stuart;* and a submarine flotilla. The 12-inch gun, it will be observed, is no longer represented in the fully commissioned strength of the navy, all ships armed with this caliber having passed into the reserve. An exception to this rule is the New Zealand, at present conveying Lord Jellicoe on his tour of the Dominions. Notable absentees from the commissioned fleets are the *Agincourt,* whose peculiar design and battery of fourteen 12-inch guns unfit her for work with the newly "standardized" formations; the *Canada,* whose 14-inch guns would complicate the ammunition supply; and the "large light cruisers" *Glorious* and *Courageous,* which, in view of their limited fighting value, are apparently considered too expensive to maintain in commission. In all, eleven dreadnought battleships and three battle cruisers are to be kept in reserve.—*The Engineer, 6/27.*

ROYAL AUSTRALIAN NAVY.—Before the departure of the battle cruiser *Australia* from Fremantle serious trouble occurred on board. The men declared that the officers had failed fully to reciprocate the welcome of the residents. The captain refused to delay the departure of the vessel as she was bound by schedule time. The men thereupon refused to get up steam, and the petty officers had to be ordered to do so. When the vessel was a few hours out at sea the captain read the King's Regulations covering mutiny and disobedience. The men then returned to their posts. Nearly 50 were arrested and six were placed under close arrest awaiting a court-martial, which will probably be held at Sydney. Only a few privileged visitors were allowed on board the cruiser during her stay at Adelaide, and only a few sailors, mostly English, were permitted ashore. The *Australia* arrived at Melbourne on Tuesday, when Commodore Dumaresq stated that conditions on board the vessel were normal.—*Army and Navy Gazette,* 6/14.

THE REVIVAL OF THE TORPEDO BOAT.—One of the most novel and successful types of fighting craft developed for service in the Channel and the North Sea was a small high-speed vessel to which the British gave the name of Coastal Motor Boat. These little vessels were in a sense a revival of the original torpedo boat, which was abandoned many years ago by all the navies of the world. The similarity lies in the high speed and small size both of the original and its modern revival; but whereas the torpedo boat possessed a round hull of the type prevalent in those days and was driven by steam engines at a speed of from 18 to 22 knots, the modern coastal motor boat is nothing more nor less than a racing motor boat of a modified hydroplane type, equipped with internal combustion engines and driven at speeds of from 35 to 40 knots.

The principal motive for building these boats was to enable a torpedo attack to be carried on in shoal, coastal waters. Large torpedo carriers such as destroyers and submarines are limited in their inshore operations by their comparatively heavy draft of eight to ten feet, which confines them to fairly deep water and exposes them to danger from mines. Early

in the war, there was a call for the development of a fleet of small, high-speed craft, drawing only a foot or two of water and capable of carrying and launching the torpedo, and the Thornycroft firm who built the first 60-foot torpedo craft in 1878, designed a high-speed motor boat with a special form of hydroplane hull, and equipped with a torpedo carried in a dropping gear such as is still used in naval boats. With the collaboration of Lieutenants Hampden, Brenner and Anson, of the Harwich force, designs were prepared for a 30-knot boat of the racing motor boat general type, capable of carrying a torpedo and the necessary discharge gear for the torpedo, with tanks for extra fuel.



THESE 40-KNOT BOATS DID NOT HESITATE TO ATTACK ENEMY DESTROYERS. THEY PERFORMED GOOD WORK AT ZEEBRUGGE AND OSTEND.

At the outset it was necessary to dismiss the proposed dropping gear, first because it was unsuitable for torpedoes larger than 14-inch, and secondly because it necessitated the slowing down of the boat before the torpedo could be launched. The three officers above mentioned, who volunteered to take charge of the boats, insisted that as the sole object of the new craft was to attack, arrangements should be made to discharge the torpedo as the boat advanced at high speed. Launching from a trough at the bow by means of a ram impulse gear, as was done in the early torpedo boats, did not conduce to safe and accurate practice, and launching from the stern would have necessitated turning for the attack to be made. Eventually it was determined to discharge the torpedo over the stern, tail first. The boat was built with this idea incorporated. The accompanying drawings are based upon illustrations which appeared in *The Engineer*, London, of June 6, 1919; and reference may be made to that issue for fuller details than are here given.

Since a naval weapon loses much of its value if the enemy is forewarned, the boats were built on an island in the Thames and every precaution was made to secure secrecy. The first three boats, finished in April, 1916, were tried out, mostly in the night time, at Queensborough, and

after a period of training four boats were sent to Dunkirk where contact with the enemy was soon established. The coastal motor boat at once justified its existence by torpedoing a large German destroyer. On several occasions in this attack the boats came under heavy machine gun-fire and, although they were frequently hit, the little craft succeeded in regaining port.

They carried one 18-inch torpedo in a rack let into the deck at the stern, the after end of the rack extending well beyond the stern and thus serving the same purpose as the "spoon" of a torpedo tube.

The method of attacking was simple and proved to be effective. When the enemy was sighted the coastal motor boat headed for it at full speed, the torpedo being launched tail first over the stern by means of a launching ram, as soon as the target was in range. Immediately after letting go the torpedo, the helm was thrown hard over and the boat turned off, as shown in the insert sketch on our drawing, the torpedo racing past on the original course toward the target.

Later, the firm built for the Admiralty large numbers of a larger type, 55 feet in length. This is the boat shown in our drawings. The dimensions were: Length, 55 feet; beam, 11 feet; extreme draft, 3 feet. Provision was made for two torpedoes, and for defense against aircraft and small surface vessels four machine guns were carried. It should be noted that some of the 55-footers were armed with one torpedo and four depth charges. They were driven by 375-horsepower motors, which at 1250 revolutions gave a speed of 38 knots. When fully opened out they made 41 knots and over.

The work of the C. M. B.'s during the war was not confined to torpedo attack. All these little fellows—"scooters" as they came to be termed in the navy—were gradually called upon to perform multifarious duties. They were very active off the Belgian coast and Belgians who lived through the German occupation stated that the enemy had conceived a wholesome respect for them. Frequently they came under fire from the German batteries, and more than one was lost as the result of a direct hit with a shell. They had no fear of destroyers and frequently intercepted the German boats when they were returning from raids on the Dover barrage. Their very high speed enabled them to get away from the destroyers after delivering an attack. Enemy airplanes, however, were a more serious matter, for these attacked them with bombs and machine-gun fire.

Some of the best work of the C. M. B.'s was done in the blocking operations at Zeebrugge and Ostend. Their work was to create smoke screens (which they did by moving ahead of the other vessels at full speed and sending out smoke clouds from the exhaust by means of a special smoke-producing device), and to lay down flares, to show where the block ships were to turn. At Zeebrugge two of them entered the harbor to torpedo a vessel alongside the Mole; others, temporarily armed with Stokes mortars, attacked the airplane hangars. Also, when the *Vindictive* was sent in to block Ostend, two coastal motor boats were given the work of torpedoing the ends of the piers, so as to put the guns which were mounted thereon out of action.—*Scientific American*, 7/12.

NOVEL SALVAGE FLEET.—The first of a new type of "mystery ship" for the British Admiralty has been completed at Southwich, near Brighton. Unlike the "mystery ships" built during the war, the new vessels are not intended for destruction, but for salvaging merchant vessels sunk by German submarines around the coast of the United Kingdom. Six ships of the new type are to be built, each at a cost of nearly £1,000,000.

The position of the sunken merchantmen has been ascertained by divers of the Admiralty salvage department, who have reported that in many cases the ships can be raised and refitted for service.

The salvage ships present the appearance of a series of towers, with a broad foundation shaped like a ship. The towers rest on one another like

widening tracks, and each diminishes in size to the top one, which is more than 100 feet above the base.

Each tower is made up of numerous hollow blocks of concrete curved to withstand internal pressure. They have water-tight doors by which the blocks can be filled with water, and pumps to replace the water with air.

Having no motive power of their own, the ships are to be towed in pairs to where a sunken merchantman has been located. On a calm day the hollow concrete blocks will be filled with water and the ships will be sunk on either side of the wreck. Divers will fasten them tightly to the wreck. The water then will be pumped from the blocks, and the ships, it is expected, will rise, bringing the wreck to the surface.—*Nautical Gazette*, 6/21.

BRITISH WAGES DOUBLED.—In accordance with Admiralty decisions arising out of recommendations of a committee over which Admiral Sir Martyn Jerram presided, the pay of petty officers, non-commissioned officers and men in the Royal Navy and Royal Marines will be more than doubled by an order just issued. The question of officers' pay is still under consideration by a committee under Rear Admiral Sir Lionel Halsey. The increase in substantive pay will be antedated to February 1 for all men still in the service on May 1 and not discharged before that date. The increase in the pay of the navy, as one English newspaper puts it, "makes it an occupation in which a man can hope to be as well paid for his services as he would be ashore."

The total cost of the increase will be annually 6,148,000 pounds, approximately $28,280,800 at the existing relative value of the pound sterling. Of that sum 2,839,000 pounds will go in increase of pay, 656,000 pounds in increased allowances and 2,653,000 pounds in increased pensions.

How Increases Apply.—The increase, according to rating, is shown in the following table:

	Old rate per day Cents	New rate Cents
Able seaman	.41	.92
Petty officer	.77	1.61
Chief P. O.	.97	1.94
Yeoman of signals	.85	1.71
Chief sailmaker	.95	2.07
Engine-room artificer, first class	1.62	2.53
Chief E. R. A., first class	1.85	2.86
Stoker, first class	.51	1.04
Stoker P. O.	.51	1.71
Chief stoker	1.00	2.07
Third writer	.49	1.02
Chief writer	1.27	2.15

The Royal Marines will in future be paid on the same basis as the navy, and in this corps the increases given vary from 1s. 7d. to a private in the R. M. L. I. (making his pay 2s. 9d. a day) to 5s. 3d. a day for the company sergeant-major (making his pay 10s. a day). The new rates are to date, as in the navy, from February 1, so there will be a nice little accumulation of back pay to come on the next pay day. Increases are also made in allowances for good conduct and other things. These are thus summarized: Good conduct badges 3d. a day instead of 1d.; working suit allowances merged in kit upkeep allowance, which is increased by 10s. a year for all ratings, and 12s. a year for engine room, electrical and ordnance artificer ratings; national health insurance contributions will be paid by the Admiralty; grog money taken in lieu of rum ration 7s. a month instead of ½d. a day; subsistence allowance increased by 50 per cent; free transfer of discharged or invalided men and their families and effects to be sent to the future place of employment within a month of discharge

Pension Rate Higher.—There is also a considerable increase in the pension rate. Hereafter the basic rate will be 1½d. per day for each year of service instead of ½d. per day. This will mean, with the various additions for long service and good conduct, that the average pension will be 78 pounds a year instead of 40 pounds, with a possible maximum of 100 pounds. In addition to this, the Admiralty has undertaken to supplement the Greenwich Hospital funds when necessary, in order that all men may receive an extra 5d. a day at the age of 55 and 9d. a day at 65. Separation allowances will be paid until December 31, 1919, and the future of this question is to be the subject of further consideration, having regard to the cost of living.

Some interesting figures are given by the Admiralty to show what a man's weekly earnings will be in the navy under the new scales. Thus an able seaman (gunner), with less than three years' service and unmarried, who formerly received 19s. 3d. a week, will receive 2 pounds, 4s. 11½d. a week. A petty officer (leading torpedo man), two good conduct badges, married with two children, will receive 4 pounds, 17s. 8½d. instead of 1 pound, 11s. 6d. A chief petty officer (gunner's man), over six years' service, three good conduct badges, single, will receive 5 pounds, 1s. ½d. instead of 2 pounds, 8s. 5d.

Thus the common British seaman who has been too long neglected is at last coming into his own.—*Baltimore Sun*, 7/6.

As from February 1, 1919, the following amounts will be added to substantive pay as a bonus to all officers of the Royal Navy, both permanent and entered for "hostilities only," to the Reserves, and the Royal Marines, and will be continued until the permanent rates can be settled:

Royal Navy	Per day s.	d.	Royal Marines	Per day s.	d.
Warrant officers, R. N.	3	6	Warrant officer, class 2	2	6
Commissioned warrant officers and mates	4	0	Warrant officer, class 1	3	0
Sub-lieutenants and acting sub-lieutenants	3	6	Second lieutenant	3	6
Lieutenants	4	6	Lieutenant	4	0
Lieutenant commanders	5	0	Captain	4	6
Commanders	5	6	Major	5	0
Captains and above	6	0	Lieutenant colonel	5	6
			Higher ranks	6	0

—*Journal of the Royal United Service Institution*, May, 1919.

JAPAN

PLAN FOR THE ORGANIZATION OF THE JAPANESE NAVY.—Relating to our Imperial Navy and army matters, according to the eighth term of the International League Regulations, our authorities have made a general outline of the scope of our naval and military plans after scrupulous consideration.

Accordingly, it was debated previously by the Cabinet Council and also on the 17th instant at the Extraordinary Diplomatic Investigation Meeting, when Tanaka, the Minister of War, and Kato, the Minister of the Navy, gave minute explanation about our military and naval plans. Although there was a little controversy over the opinion of Count Mujoji Ito, in general we have reached a decision on the scope of our Imperial naval preparations. Owing to further investigations on that subject, our authorities will submit a report at the proper time, after making several investigations and after receiving the Imperial sanction.

According to a reliable source, our naval plans would be reported at the meeting of the International League. Our fleet organization will include three squadrons of eight war ships. This was decided at the meeting of admirals last year, and was given the Imperial sanction. That is, the main body will consist of 24 ships consisting of eight battleships, which belong

to the first period of the ship's age (*i. e.* within eight years after completing), eight battle cruisers, and eight battleships. According to previously decided plan of the organization of the Imperial Navy, our authorities expected as a first step the completion of the so-called 8:6 fleet before the 12th year of Taisho (1923). The main body is organized with two battle cruisers which were appended at the time of the Terauchi Ministry, two battleships of the first period of ship's age (reckoning in temporarily the *Fuso* which should be entered in the second period of ship's age in the 12th year of Taisho, 1923), and six battle cruisers (by including the *Haruna* and the *Kirishima* which should be put in the second period ship's age). Then they planned for the accomplishment of the complete 8:8 fleet which is organized of eight battleships of the first period and eight battle cruisers. However, from the standpoint of our Imperial geographical condition and world position, we can hardly expect to feel satisfied with the previously decided plan.

Judging from the statement by Mr. Daniels, Secretary of the American Navy, which he made before the House Committee on Naval Affairs on January 4 of this year, the American Navy will be divided between the Pacific and Atlantic fleets this coming summer. It is clear that half of the American Navy will be stationed in the Pacific Ocean. As for England, according to a foreign telegram, it is reported that she has decided to send a new formation of the oriental fleet which will be larger than that of the hitherto existing fleet which has been sent to China in the past. Our empire should pay attention to those nations.

For the sake of our Imperial position, that is, to certify our superior position in the Far East, to keep the perpetual peace of the Orient and furthermore for the protection of our newly-authorized dominions, as well as for the protection of our foreign trade, we must enlarge our previously decided plan and our military force. In short, under the present Imperial Navy, it is necessary for Japan to possess a fleet of three squadrons of eight warships, and it is said that our authorities have decided to report this as a plan concerning the Japanese Naval Organization. In fact, the above plan is simply a positive necessity for our national defence at present. To commence its practice is another matter. It lies in the far future on account of our financial condition and the possibility of constructing ships. At the 41st Diet, that adjourned March 27, 1919, the plan, of three squadrons of eight ships, of Kato, Minister of the Navy, is simply the aim which our Imperial Navy should adopt in the future. Its practice is entirely a different matter. Judging from his declaration regarding the difficulty of its practice, it seems impossible to enter into its practice within about ten years.—Translation from "*Yamato*," a Japanese newspaper, 5/28.

JAPANESE AEROPLANE POLICE IN FORMOSA.—An aeroplane police force is to be organized by the Formosan Government. After passing a bill for the estimated cost of the machines, about yen 200,000, during the Twenty-first Diet, the government sent a request to the War Department for the construction of the flying machines. There are to be two aeroplanes of Maurice Farman style, two Renault style motors of 70 horsepower, and three machines for preliminary tests.—"*Yoruzo*," a Japanese newspaper, 5/29.

JAPAN MAKES APOLOGY FOR TIENTSIN ATTACK.—Now that Japan has made a formal apology to the United Stated for the unprovoked attack by Japanese on men of the 15th U. S. Infantry at Tientsin, China, March 12, and for the affronts to P. Stewart Heintzlemann, the American Consul General, which occurred at the same time, the unhappy incident can be considered closed. The formal apology, accompanied by expressions of regret, places the Japanese in the position of being in the wrong and admitting it, and it serves as a notice that the United States Government will expect Japan to prevent incidents of this character in the future. The apology of the Japanese Government has been made all the more unre-

served and complete by frank admission of Japan's blame and no counter charges against the Americans. Apologies were tendered to Paul S. Reinsch, the American Minister at Pekin, and to Mr. Heintzlemann, and were addressed to Col. William T. Wilder, who commanded the 15th Infantry, but had been transferred.—*Army and Navy Journal, 7/5.*

UNITED STATES

Navy Department—Bureau of Construction and Repair

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, AND PROBABLE DATES OF COMPLETION, AS REPORTED JUNE 30, 1919

Type, number and name	Contractor	Per cent of completion July 1, 1919 Total	On ship	Probable date of completion
Battleships[1]				
43 Tennessee	New York Navy Yard	79.1	74.6	2/—/20
44 California	Mare Island Navy Yard	65.6	56.6	Indeterminate
45 Colorado	New York S. B. Co	26.8	5.6	1/—/22
46 Maryland	Newport News S. B & D. D. Co.	49.7	39.9	6/—/21
47 Washington	New York S. B. Co	26.2	5.3	7/—/22
48 West Virginia	Newport News S. B. & D. D. Co	23.4	2.2	Indeterminate
49 South Dakota	New York Navy Yard	0.	0.	"
50 Indiana	New York Navy Yard	0.	0.	"
51 Montana	Mare Island Navy Yard	0.	0.	"
52 North Carolina	Norfolk Navy Yard	0.	0.	"
Battle Cruisers				
1 Lexington	Fore River S. B. Co	....	....	"
2 Constellation	Newport News S. B. & D. D. Co.	....	....	"
3 Saratoga	New York S. B. Co	....	....	"
4 Ranger	Newport News S. B. & D. D. Co.	....	....	"
5 Constitution	Phila. Navy Yard	....	....	"
6	Phila. Navy Yard	....	....	"
Scout Cruisers				
4	Todd D. D. & Const. Co	28.2	6.1	8/—/21
5	Todd D. D. & Const. Co	26.4	4.9	12/—/21
6	Todd D. D. & Const. Co	21.7	1.2	7/—/22
7	Beth. S. B. Co. (Fore River)	0.	0.	Indeterminate
8	Beth. S. B. Co. (Fore River)	0.	0.	"
9	Wm. Cramp & Sons Co	12.	....	8/1/21
10	Wm. Cramp & Sons Co	12.	....	9/15/21
11	Wm. Cramp & Sons Co	2.	....	11/15/21
12	Wm. Cramp & Sons Co	2.	....	12/15/21
13	Wm. Cramp & Sons Co	2.	....	2/15/22
Miscellaneous[2]				
Fuel Ship No. 16, Brazos	Boston Navy Yard	97.	96.5	9/—/19
Fuel Ship No. 17, Neches	Boston Navy Yard	25.	10.	8/—/20
Fuel Ship No. 18, Pecos	Boston Navy Yard	.2	.2	Indeterminate
Gunboat No. 21 Asheville	Charleston Navy Yard	88.1	83.1	11/1/19
Gunboat No. 22	Charleston Navy Yard	.4	.3	12/30/20
Hospital Ship No. 1, Relief	Phila. Navy Yard	37.1	29.4	9/1/20
Amn. Ship No. 1, Pyro	Puget Sound Navy Yard	92.	86.	1/1/20
Amn. Ship No. 2, Nitro	Puget Sound Navy Yard	52.	36.	5/1/20
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	....	....	....

[1] Battleships authorized but not under construction or contract (2) Nos. 53 and 54.
[2] Miscellaneous vessels authorized but not under construction or contract (4):
1 submarine tender No. 3.
2 destroyer tenders Nos. 3 and 4.
1 transport No. 2.

There are 166 destroyers, 65 submarines, 9 mine sweepers, 18 sea-going tugs, 26 harbor tugs, 12 oil tankers and 45 Ford eagles in various stages of completion. About 81 destroyers will probably be completed this year and the remainder in 1920. Twelve destroyers were completed and delivered to the Navy Department during the month of June.

There are 12 additional destroyers and 10 submarines authorized but not under construction or contract.

NAVAL POLICY

U. S. FLEET ORGANIZATION COMPLETED.—The Office of Naval Operations, Navy Department, has finally completed the assignment of vessels comprising the new fleets and the corrected list of ships composing the four large divisions is announced as of July 1. The changes embrace a rearrangement among the smaller classes of vessels and the assignment of submarine chasers to operate from Kirkwall, England, with the North Sea mine sweeping detachment, also for assembling at Lisbon for the return to the United States. The important changes are the withdrawal of Division 3 of Cruiser Squadron 1, Atlantic fleet, and of Division 4 of Cruiser Squadron 2, Pacific fleet. The cruiser *Pueblo* is assigned as flagship of the Asiatic fleet, the cruiser *Brooklyn* acting as temporary flagship.

Secretary Daniels on July 9 announced that the Pacific fleet will leave Hampton Roads on Saturday, July 19, and is expected to arrive on the west coast between August 5 and 10. It is possible, he said, a brief stop will be made at Panama.

The fleet organization as of July 1 is as follows:

U. S. ATLANTIC FLEET

Admiral Henry B. Wilson, Commander-in-Chief

Fleet Flag: *Pennsylvania*

Battleship Squadron Two

Division 3: Rear Admiral Hilary P. Jones; Flag *Connecticut; Louisiana, New Hampshire* and *Kansas.*

Division 4: Rear Admiral Thomas Washington; Flag *Minnesota; South Carolina* and *Michigan.*

Battleship Squadron Three

Rear Admiral E. W. Eberle; Flag *Pennsylvania*

Division 5: Flag *Utah; Florida, Delaware* and *North Dakota.*

Division 7: Admiral Henry B. Wilson; Flag *Pennsylvania; Oklahoma, Nevada* and *Arizona.*

Cruiser Squadron One

Flag *Huntington*

Division 1: Flag *Huntington; Wheeling, Topeka* and *Castine.*

Destroyer Squadron Three (Active)

Rear Admiral C. P. Plunkett; Flagship *Rochester*

Flotilla One.—Tender *Dixie.* Division 5: *Caldwell, Craven, Gwin, Conner, Stockton* and *Manley.* Division 6: *Little, Kimberly, Sigourney. Gregory, Strongham* and *Dyer.* Division 7: *Colhoun, Stevens, McKee, Robinson, Ringgold* and *McKean.*

Flotilla Two.—Flagship *Rochester.* Tender *Bridgeport* (temporary detached duty). Division Eight: *Harding, Gridley, Fairfax, Taylor, Bell* and *Mahan.* Division 9: *Murray, Israel, Luce, Maury, Lansdale* and *Stribling.* Division 28: *Belknap, McCook, McCalla, Rodgers, Ingram* and *Bancroft.*

Flotilla Three.—Flagship *Rochester.* Tender *Panther* (temporary detached duty). Division 19: *Breckenridge, Barney, Blakely, Biddle, Dupont* and *Bernadou.* Division 20: *Ellis, Cole, J. Fred Talbot, Hale, Crowninshield* and *Tillman.* Division 22: *Meredith, Bush, Cowell, Maddox, Boone and Kalk.*

Destroyer Squadron One (Reserve)

Flagship *Chester*

Flotilla Seven.—Tender ——. Division 1: *Cassin, Balch, Benham, Duncan, Downes, Aylwin* and *Parker*. Division 2: *Ericson, O'Brien, McDougal, Winslow, Cushing* and *Nicholson*. Division 3: *Wadsworth, Conyngham, Tucker, Wainwright, Porter* and *Cummings*.

Flotilla Eight.—Flagship *Chester*. Tender ——. Division 4: *Davis, Allen, Shaw, Wilkes, Campson* and *Rowan*. Division 25: *Dahlgren, Goldsborough, Semmes, Satterlee, Mason* and *Graham*. Division 26: *Chandler, Southard, Hovey, Long, Broome* and *Alden*.

Flotilla Nine.—Flagship *Chester*. Tender ——. Division 27: *Hatfield, Brooks, Gilmer, Fox, Kane* and *Humphreys*. Division 24: *Hopewell, Thomas, Haraden, Abbott, Bagley* and *Clemson*. Division 36: *Dickerson, Leary, Schenck, Herbert, 193* and *194*.

Submarine Detachment, Atlantic

Division 7: Tender *Camden, S-4, S-5, S-6, S-7, S-8, S-9, S-10* and *S-11*. Division 12: Tender *Rainbow, S-25, S-26, S-27, S-28* and *S-29*. Division 15: Tender *Bushnell, AA-1, AA-2* and *AA-3*.

Mine Detachment, Atlantic

Squadron One (Layers).—Flag *San Francisco, Shawmut*.

Squadron Two (Sweepers).—Division 1: *Auk, Curlew, Grebe, Osprey, Pigeon* and *Woodcock*. Division 2: *Chewink, Cormorant, Lark, Mallard, Qual* and *Swan*.

Train, Atlantic Fleet

Rear Admiral H. McL. P. Huse; Flag *Columbia*

Repair Ship: *Prometheus*. Hospital Ships: *Solace, Mercy*. Supply Ships: *Bridge* and *Culgoa*. Fuel Ships: *Nereus, Mars, Nero, Cæsar, Proteus, Arethusa, Maumee, Pecas*. Target Repair Ship: *Lebanon*. Tugs: *Allegheny, Sagamore, Patuxent, Patapsco, Lykens, Arapaho, Chemung, Wando, Potomac, Peacock, Warbler* and *Willett*.

U. S. PACIFIC FLEET

Admiral Hugh Rodman, Commander-in-Chief

Fleet Flag: *New Mexico*

Battleship Squadron One

Division One: Vice Admiral Clarence S. Williams; Flag *Virginia; New Jersey* and *Rhode Island*.

Division 2: Rear Admiral William R. Shoemaker; Flag *Georgia; Nebraska* and *Vermont*.

Battleship Squadron Four

Flag *New Mexico*

Division 6: Rear Admiral Robert E. Coontz; *Wyoming, Arkansas, New York* and *Texas*.

Division 8: Flag *New Mexico; Tennessee, Idaho* and *Mississippi*.

Cruiser Squadron Two

Flag *Seattle*

Division Two: Flag *Seattle; Cleveland, Denver, Tacoma, Marblehead, Machias* and *Vicksburg*.

Destroyer Squadron Four (Active)

Rear Admiral H. A. Wiley; Flagship *Birmingham*

Flotilla Four.—Tender *Melville.* Division 10: *Schley, Champlin, Mugford, Chew, Hazelwood* and *Williams.* Division 11: *Crane, Hart, Ingraham, Ludlow, Burns* and *Anthony.* Division 12: *Lamberton, Radford, Montgomery, Breese, Gamble* and *Ramsay.*

Flotilla Five.—Flagship *Birmingham.* Tender *Prairie.* Division 13: *Buchanan, Philip, Upshur, Greer, Elliott* and *Aaron Ward.* Division 14: *Rathburne, Talbot, Dent, Dorsey, Roper* and *Waters.* Division 15: *Tarbell, Yarnall, Wickes, Evans, Lea* and *Woolsey.*

Flotilla Six.—Flagship *Birmingham.* Tender *Buffalo* (temporary detached duty). Division 16: *Tattnall, Badger, Twiggs, Babbitt, DeLong* and *Jacob Jones.* Division 17: *Howard, Kilty, Kennison, Stansbury, Claxton* and *Hamilton.* Division 18: *Boggs, Ward, Palmer, Thatcher, Walker* and *Crosby.*

Destroyer Squadron Two (Reserve)

Flagship *Salem*

Flotilla Ten.—Tender *Blackhawk* (temporary detached duty). Division 29: *Welles, Aulick, Turner, Gillis, Delphy* and *McDermut.* Division 30: *Laub, McLanahan, Greene, Ballard* and *Shubrick.* Division 31: *Bailey, Thornton, Morris, Tingey, Swasey* and *Meade.*

Flotilla Eleven.—Flagship *Salem.* Tender ——. Division 22: *Sproston, Rizal, McKenzie, Renshaw, O'Bannon* and *Hogan.* Division 23: *Sinclair, McCawley, Moody, 278, 279* and *280.* Division 35: *212, 213, 214, 215, 216* and *217.*

Flotilla Twelve.—Flagship *Salem.* Tender ——. Division 32: *Chauncey, Fuller, Percival, John Francis Burns, Farragut* and *Somers.* Division 33: *Stoddert, Reno, Farquhar, Thompson, Kennedy* and *Paul Hamilton.* Division 34: *William Jones, Woodbury, S. P. Lee, Nicholas, Young* and *Zeilin.*

Submarine Detachment, Pacific

Division 11: Tender *Savannah. S-1, S-18, S-19, S-20, S-21, S-22, S-23* and *S-24.* Division 16: Tender *Beaver. S-31, S-32, S-33, S-34, S-35* and *S-36.*

Mine Detachment, Pacific

Mine Squadron Three (Layers).—Flag *Baltimore, Aroostook.*

Mine Squadron Four (Sweepers).—Division 3: *Ortolan, Partridge, Redwing, Sea Gull, Thrush* and *Whippoorwill.* Division 4: *Tanager, Lapwing, Tern, Bittern, Sandpiper* and *Vireo.*

Train, Pacific Fleet

Flag *Minneapolis*

Repair Ship: *Vestal.* Hospital Ship: *Comfort.* Supply Ships: *Rappahannock, Glacier* and *Celtic.* Fuel Ships: *Orion, Vulcan, Neptune, Brutus, Jupiter, Jason, Neches, Kanawha, Cuyama* and *Brazos.* Target Repair Ship: *Nanshan.* Tugs: *Iroquois, Ontario, Sonoma, Undaunted, Dreadnought, Aspinet, Mohave, Sea Rover, Brant, Cardinal* and *Gannet.* Radio Repair Ship: *Saturn.*

U. S. NAVAL FORCES, EUROPEAN WATERS

Cruiser Detachment.—Flag *Pittsburgh, Galveston, Chattanooga, Des Moines, Sacramento, Olympia, Eagle No. 1, Eagle No. 2* and *Eagle No. 3.*

Destroyer Detachment.—*Badger, Barney, Belknap, Blakely, Crane, Dorsey, Evans, Greene, Greer, Gridley, Hazelwood, Israel, McCook, Upshur, Williams, Aaron Ward, Lea, Luce, Manley, McCalla, Ellis* and *Roper.*

Tender Detachment.—Bridgeport, Hannibal, Leonidas, Buffalo, Panther and *Black Hawk.*

Salvage Detachment.—Chesapeake, Manna Hatta and *Utowonah.*

Tugs and Yachts.—Anderton, Barnegat, Cahill, City of Lewes, Concord, Conestoga, Criccieth, Dreadnought, Hinton, Hubbard, McNeal, Penobscot, Undaunted, Goliah, Patapsco, Patuxent and *Noma.*

Mine Sweeping Detachment.—Curlew, Osprey, Robin, Turkey, Swan, Kingfisher, Boblink, Swallow, Rail, Pelican, Eider, Teal, Heron, Oriole, Sanderling, Auk, Tanger, Lapwing, Avocet, Whippoorwill, Lark, Quail, Penguin, Chewink, Widgeon, Woodcock, Sea Gull, Grebe, Flamingo, Thrush. Trawlers: *Ashton, Blackhorn, Buckley T., Buckley R., Burton, Caharty, Clark, Clay, Cochrane, Collins, Duffy, Dunkan, Darold, Fitzgerald, Graham J., Graham T., Hendrix, Johnson, Laundry* and *Caldwell.*

U. S. ASIATIC FLEET

Vice Admiral W. L. Rogers, Commander-in-Chief

Squadron One.—Division 1: Flag *Pueblo* (temporary). Flag *Brooklyn, New Orleans* and *Albany.* Division 2: *Helena* and *Wilmington.* Division Three: *El Cano, Pampango, Villalobos, Quiros, Palos, Samar* and *Monocacy.* Auxiliaries: *Ajax* (assigned to Guam), *Piscataqua, Abarenda* and *Pompey.*

Naval Stations: Cavite, Olongapo, P. I., and Guam.

Station Ships: At Cavite: *Mohican;* Guam: *Supply.* Yard Craft: *Wompatuck* and *General Alava.*

DETACHED SERVICE

Santo Domingo: *Peoria, May.* St. Thomas: *Vixen.* Guantanamo: *Osceola.* Pearl Harbor: *Chicago* (station ship). Bermuda: *Tallahassee.* Constantinople: *Scorpion* (station ship).

OUT OF COMMISSION OR TO BE SO PLACED

Battleships: *Alabama, Illinois, Kearsarge, Kentucky, Oregon, Wisconsin, Indiana, Massachusetts, Iowa.*

Cruisers: *Cincinnati, Raleigh.*

Monitors: *Monterey, Monadnock, Amphitrite, Ozark.*

Gunboats: *Dubuque, Elcano, Annapolis, Marietta, Anniston, Petrel, Yorktown, Pampanga, Quiros, Samar, Villobos, Don Juan De Austria, Isla De Luzon.*

Destroyers: *Bainbridge Barry, Dale, Decatur, Hopkins, Hull, Lawrence, McDonough, Paul Jones, Preble, Perry, Stewart, Truxton, Whipple, Worden, Smith, Lamson, Preston, Flusser, Reid, Paulding, Drayton, Roe, Terry, Perkins, Sterrett, McCall, Burrows, Warrington, Mayrant, Monaghan, Trippe, Walke, Ammen, Patterson, Fanning, Jervis, Henley, Beale, Jouett, Jenkins.*

Mine Sweepers: *Anderton, Barnegat, Cahill, City of Lewes, Concord, Conestoga, Dreadnaught, Genesee, Goliah, Hinton, Hubbard, McNeal, Montauk, Nahant, Penobscot, Sea Rover, Undaunted, Utowana, Arctic.*

Tenders: *Alert.*

Auxiliaries: *Sterling.*

Naval Transports: *Hancock.*

Yachts: *Aphrodite, Carola IV, Galatea, Harvard, Margaret, Nahima, Noma, Piqua, Rambler, Yankton, Despatch, Nokomis, Sialia, Arcturus, Bache, Explorer, Forward, Isis, Surveyor, Wenonah, Albatross, Fishhawk, Dorothea, Kwasind, Eagle, Remlik, Ranier, Christabel, Corona, Druid, Emeline, Wadena, Wanderer, Yacoma, Sylph, Niagara.*

Tugs: *General Alva.*

IN RESERVE OR TO BE PLACED IN RESERVE

Battleships: *Maine, Missouri, Ohio.*

Armored Cruisers (to be placed in Ordinary with 10 per cent crews): *Frederick, Montana, North Carolina, South Dakota, Charleston, St. Louis.*

Monitors: *Cheyenne, Tallahassee, Tonopah.*

Gunboats: None.

Hospital Ship: *Solace.*

Submarines: A number to be named in supplementary lists.

(NOTE.—Also those destroyers assigned to Squadrons One, Two, Three and Four from time to time pursuant to orders from the department, and in accordance with a policy to be promulgated.)—*Army and Navy Journal*, 7/12.

PROBABLE PERMANENT NAVY.—It is expected that 16 first-class battleships, including the *Tennessee* which is nearly ready for commission, and 13 second-class battleships will make up the main force of the navy during the next year.

It is expected that about 20 Eagle boats and gun boats and 152 destroyers will bring the total up to about 716 ships to remain in commission during the next year.

It developed before the hearings of the House Naval Committee that the Bureau considers the Eagle boats a better type of vessel than our old gun boats. Only three Eagle boats have been placed in full commission to date, 57 Eagles are not yet completed. During the year it is expected that about 20 Eagle boats will be commissioned to take the place of gun boats and that 37 will be placed in reserve.—"*Our Navy*," July, 1919.

OUR NEW BATTLE CRUISERS.—The construction of the six battle cruisers for the United States Navy authorized under the 1916 building program, which with the two battleships on the same program the general board of the navy has wisely urged should be completed "as expeditiously as possible." will secure to the navy the most powerful battle cruisers afloat. They will be armed with guns the equal in caliber of those of the most powerful battleship ever launched, or so far as known at present contemplated. With their increased armor protection and great speed, officers who strongly favor this type of ship hold that they would, in a long range action, be able to give a battleship all she wanted, as the battle cruisers by their superior speed can choose their own fighting distance, and with guns of the greatest caliber can give hard knocks as well as receive them.

We are authoritatively informed that each of the new battle cruisers will carry eight 16-inch guns in turrets, with secondary batteries of fourteen 6-inch guns, as originally planned, and that no change in the battery armament will be made, despite rumors to the contrary. In addition the battle cruisers will carry four 3-inch anti-aircraft guns. They will also be provided with four 21-inch submerged torpedo tubes, and four 21-inch torpedo tubes above the water. They will be equipped with turbine engines and electric reduction gear. Each ship will be provided with 20 boilers using oil fuel; the estimated indicated horsepower on trial of the main engines is 180,000.

The under-water protection against torpedo attack and mines will be unusually complete and will include features which the experience of the war has shown to be of vital importance. As a result of the experience of British warships in the battle of Jutland, the general board, among other improvements in constructing, has decided to give additional armor protection, particularly to turrets, turret armor and turret tops, conning towers, magazines, decks and communications, if necessary at the cost of a small reduction in speed. As the estimated speed of the new cruisers, as first planned, is 35 knots, the extra protection to vitals will more than compensate for a slight loss of speed, which at most should not be a serious factor.

The six battle cruisers are sister ships and in length will be the largest vessels in the United States Navy and among the biggest in the world, measuring 850 feet between perpendiculars (57 feet less than the transport *Leviathan*). They have a beam of 90 feet and a mean draft of 31 feet 3½ inches. Their normal displacement is 35,300 tons, or 121 tons per inch of immersion. They will be superior in every way to the British battle cruisers *Repulse* and *Renown* built during the war, which proved such highly successful craft. The new battle cruisers will also be more powerful and up-to-date than the British battle cruiser *Hood*, soon to be commissioned, which at present represents the last word in battle cruiser construction. Whereas, however, the *Hood* is nearly completed, our six great battle cruisers, the *Constellation, Constitution, Lexington, Ranger, Saratoga* and No. 6 (not yet named), are still to be constructed and can therefore embody further improvements, especially as our Construction Corps, Ordnance Corps and Bureau of Steam Engineering have had full information as to all that is best in European navies.—*Army and Navy Journal*, 6/21.

MATÉRIEL

TO PREVENT FOULING OF GUN BARRELS.—A method of overcoming the fouling of gun barrels, as described in the *Journal* of the United States Artillery, consists of introducing in the chamber of the gun an alloy of 60 per cent tin and 40 per cent lead by weight, which breaks up at the moment of firing, the tin uniting with the copper in the bore of the gun, and the lead acting as a lubricant for the succeeding rounds and tending to granulate and assist in the removal of the fused brass alloy formed by the above-mentioned reaction.—*Scientific American*, 7/5.

NAVY DEPARTMENT PURCHASES STEEL.—Acting under authority conferred by war emergency legislation, the Navy Department, on May 14, placed an order amounting to a requisition with the Carnegie Steel Co. for 14,000 tons of steel to be used in the construction of new battleships. In announcing the action of his department, Assistant Secretary Roosevelt said: "The navy placed with the Carnegie Steel Co. an order for about 14,000 tons of steel required for beginning construction before July 1, 1919, of battleships 49, 50, 51, and 52, ordered constructed at New York, Norfolk, and Mare Island navy yards. The order was placed at a tentative price, subject to later adjustment, after further conferences with the Carnegie Steel Co. officials. That company was the only complete bidder on the entire schedule of requirements. By placing the order with one company the navy felt assured of better service and a more convenient and economical inspection."—*Engineering World*, 6/15.

"NORTHERN PACIFIC" REPAIRED BY WELDING.—The rapid strides made in welding is astounding even the men who have faith in that method of building and repairing ships.

When the huge 526-foot army transport *Northern Pacific* ran aground in a dense fog only 300 yards from shore, off Fire Island, Long Island, N. Y., on January 2, 1919, the readers will recall the vivid newspaper accounts of the thrilling rescues by breeches buoy and overturning lifeboats of her three thousand passengers, including many wounded soldiers, and finally the successful efforts, although not until over two weeks later, of a fleet of tugboats in easing the steamship off the sand shoal and towing her to New York.

Since the *Northern Pacific* was pulled off the beach, however, her history seems to have escaped public notice. This seems strange, for the log of this immense transport now contains material for a most fascinating news sequel to her New Year adventure.

When the *Northern Pacific* was finally perched safely high and dry on the ways of a 30-foot deep dry dock in the New York navy yard, she

underwent a "physical examination," which hardly required an expert to diagnose some of her injuries caused by the waves when she was stranded. Her interior machinery was badly disabled and her turbines were thrown out of alignment. A great many of her plates were badly battered, and had to be replaced with new plates. In addition to this, the problem arose as to what should be done with her huge cast-steel frame (the casting which supported the rudder), for just above the upper rudder lug the whole section of the stern frame on which the rudder was hinged was cracked through, at a position where the frame was hollow but thick walled and measured almost two feet in diameter.

In handling this injury a mechanical repair was considered out of the question, and there remained only the alternative of making a Thermit weld, or of purchasing an enormously expensive new casting and installing it at a cost probably exceeding $50,000. Although the fracture was larger than that of any marine weld ever before made, the fundamental difficulties of such an operation were not serious. This process, therefore, was finally chosen.

When the mould had cooled it was examined and found entirely satisfactory and fit for service. On completion of her other repairs the *Northern Pacific* was relaunched on May 10.—*The Rudder,* July, 1919.

PERSONNEL

NAVAL APPROPRIATIONS PASSED.—Carrying $616,000,000, the Naval Appropriation bill, H. R. 5608, as reported from the conference committee of House and Senate, was agreed to by House and Senate on June 30, and on July 1 was sent to the White House for action of the President. The bill provides for no new warship construction whatever, but appropriates $133,000,000 for continuation of work on the ships authorized in the three-year program of 1916 and raises the authorized cost of those vessels.

Part of the new legislation enacted by adoption of this measure is briefed below.

Aviation.—The aviation needs of the navy are provided with an appropriation of $25,000,000, which is $21,000,000 less than the amount Secretary Daniels said was needed at this time to carry out the department's plans. This appropriation item, as amended in conference and adopted, specifies particularly how this fund of $25,000,000 is to be expended, as follows:

"For necessary aircraft and equipment for fleet use, $3,027,250; for purchase abroad of five special type planes, $100,000; for erection on government-owned land of two hangars for two large dirigibles, $3,700,000; for construction of one rigid dirigible, $1,500,000; for purchase abroad of one dirigible of latest type, $2,500,000; for conversion of U. S. S. *Jupiter* into an aeroplane carrier, $500,000; for conversion of two merchant vessels into aircraft tenders, $700,000; for maintenance and operation of aircraft factory, helium plant and aircraft stations, $3,008,007; for continuing experiments and development work for all types of aircraft, $6,700,000; for flying equipment for Marine Corps advanced base units, $618,000; for general and miscellaneous contingencies, $2,646,743."

Officers.—Officers of the permanent navy who have served satisfactorily during the war with the German Government in a temporary grade or rank shall be eligible under the provision of existing law for selection for promotion and for promotion to same permanent grade or rank until July 1, 1920, without regard to statutory requirements other than professional and physical examinations: Provided, That the age and grade requirement prescribed by the Act approved August 29, 1916, in the rank of commander is hereby extended from June 30, 1920, to June 30, 1921.

The Act of April 16, 1918, granting under certain conditions, to every commissioned officer of the army the right to quarters in kind for their dependents or the authorized commutation therefor, included allowances for heat and light, shall hereafter be construed to apply to officers of

navy and marine corps only during the period of the war and in no event beyond October 1, 1919.

The provision of existing law which requires Secretary of Navy to make computations semi-annually as of July 1 and January 1 of each year and to convene boards to select officers of line and of staff corps for promotion is hereby amended so that said computations shall be made and said boards shall be convened at least once each year and at such times as Secretary of Navy may direct, and boards shall recommend for promotion such number of officers as may be necessary to fill vacancies then existing and which may occur during next period of time.

The Enlisted Force: Commissioned Strength.—The total authorized enlisted strength of active list of navy is temporarily increased from 131,485 during period from July 1, 1919, to September 30, 1919, to 241,000 men, and from October 1, 1919, to December 31, 1919, to 191,000 men, and from January 1, 1920, to June 30, 1920, to 170,000 men, and the President is hereby authorized, whenever in his judgment a sufficient national emergency exists, to increase the authorized enlisted strength of the navy to 191,000 men, and Secretary of Navy is authorized to call to or continue on active service on strictly naval duties, with their consent, such numbers of male members and nurses of Naval Reserve Force in enlisted ratings as may be necessary to supply deficiencies to maintain total authorized strength for periods herein authorized. Foregoing total authorized strength shall include hospital corps, apprentice seamen, those sentenced by court-martial to discharge, enlisted men of Flying Corps, those under instruction in trade schools, and members of Naval Reserve Force so serving. During fiscal year ending June 30, 1920, no member of Naval Reserve Force shall be recalled to active duty for training or any other purpose except as hereinbefore provided: Provided, That the average number of commissioned officers of line, permanent, temporary and reserves on active duty, shall not exceed during the periods aforesaid 4 per centum of the total temporary authorized enlisted strength of the regular and temporary navy and members of the Naval Reserve Force in enlisted ratings on active duty, and the number of staff officers shall be in the same proportion as provided under existing law: Provided further, That nothing herein shall be construed as affecting the permanent, commissioned or enlisted strength of the regular navy as authorized by existing law.

The rates of pay prescribed in Section 15 of "act to temporarily increase strength of navy and marine corps," approved May 22, 1917, are hereby made permanent rates of pay of enlisted men of navy during their present current enlistment and for those who enlist or re-enlist prior to July 1, 1920, for term of such enlistment or re-enlistment.

Midshipmen.—The pay of midshipmen shall hereafter be $780 per annum.

Mileage, at five cents per mile, to midshipmen entering the Naval Academy subsequent to June 1, 1919, while proceeding from their homes to the Naval Academy for examination and appointment as midshipmen.

Hereafter there shall be allowed at the Naval Academy five midshipmen for each Senator, Representative, Delegate in Congress, and Resident Commissioner from Porto Rico, and five for District of Columbia, fifteen appointed each year at large, and 100 appointed annually from enlisted men of navy, and members of the Naval Reserve Force on active duty, as now authorized by law.

Marine Corps.—Personnel items under marine corps are the following:

The authorized enlisted strength of active list of marine corps is temporarily increased to 27,400, plus such number of men as may be serving with A. E. F. abroad: Provided, That average number of enlisted men of marine corps on active duty during fiscal year ending June 30, 1920, shall not exceed 27,400, distribution in various grades to be made in same proportion as provided under existing law.

That in making reductions required by this act, officers holding temporary appointments may be given temporary appointments in lower

grades, and officers so appointed shall take precedence from dates of their original appointments in such lower grades.

That so much of Act of July 1, 1918, as authorizes promotion of retired enlisted men of navy and marine corps ordered to active duty shall not be so construed as to make illegal promotions of such men as have heretofore been made to warrant grades or as to deprive them of any of pay, allowances or other benefits accruing under such promotion.

The accounting officers of Treasury Department are authorized and directed to allow, in settlement of accounts of disbursing officers of navy and marine corps covering period of present emergency, such credits for payments to officers and enlisted men not ordinarily allowable under the statutes, as are certified to them by Secretary of Navy as having been incurred under military necessity, or as having been occasioned by accidental circumstances or conditions over which such disbursing officers had no control and for which they were not justly responsible: Provided, That the period of present emergency as contemplated by this paragraph shall be regarded as beginning on April 6, 1917, and as terminating six months after expiration of the quarter in which peace is declared. And that nothing herein shall be construed to include payments under contracts for supplies or services.

Hereafter, except when detached by the President for duty with army, enlisted men of marine corps shall be entitled to same allowance for rations as are enlisted men of navy, under such rules and regulations as may be prescribed by Secretary of Navy.

Administrative.—The Secretary of Navy is authorized to accept from the San Diego Chamber of Commerce, San Diego, Calif., free of all encumbrance and without cost 135 acres of land on the bay of San Diego, for a naval training station thereon, providing that the city of San Diego will donate the tide lands in the bay of San Diego adjoining said lands to the bulkhead line, and also a site for a naval hospital in Balboa Park.—*Army and Navy Journal*, 7/5.

PRECARIOUS OUTLOOK FOR U. S. FLEETS.—The condition which the navy has to face with the passage of the Naval Appropriation bill is so serious that Secretary Daniels on July 2 stated he had been in conference with Admiral William S. Benson, Chief of Naval Operations, in an endeavor to prevent the prostration of the service. The precarious situation is partly due to the excessive pressure brought to bear for the immediate release of the Reserves, the four-year men who enlisted during hostilities, and those who signed for the duration of the war. The hardest blow comes through a "joker" amendment inserted in the bill by Senator La Follette, of Wisconsin, by which 12,400 four-year men who enlisted previously to the war must be released. Senator La Follette, running true to his war-time form, and insistent that a constituent who had enlisted in February, 1917, should get his release, amended the provision of the bill under "Maintenance" to read: "Any enlisted man in the navy, marine corps, or coast guard, who since February 3, 1917, and before November 11, 1918, enlisted for the period of four years shall upon his application to the Secretary of the Navy on or before September 1, 1919. be held and construed to have enlisted for the duration of the war and shall, when discharged, be granted an honorable discharge," etc. In the House bill the provision read, "who since April 7, 1917," etc. To relieve this single individual friend of Senator La Follette, a Medical Corps man serving at Quantico, Va., the navy must grant discharges to 12,400 men of the regular navy enlisted between February 3 and April 7, 1917.

Secretary Daniels stated that since the armistice, when the enlisted personnel of the navy was 524,000, approximately 284,000 men had been discharged, so that the navy to-day has of all classes of enlisted personnel 240,000. From department records it is learned that there are to-day 78,000 enlisted men in the regular navy, 50 per cent of whom were enlisted

since the armistice, leaving about 40,000 experienced enlisted men. There are 15,000 men in training, which figure, added to the 12,400 loss through the La Follette amendment, means that the navy has in men it can count upon in the next few months as sufficiently trained to work the ships about 14,000. Or in men fully or partially trained it will have available for the Atlantic, Pacific, Asiatic and European fleets a little more than 50,000, for the reservoir at training stations will always approximate 15,000. One navy officer, a chief of staff, in talking of the situation, said: "I believe the quickest way out of the mess is to discharge all the temporary men. And I told Admiral Benson the navy would rise from its position of prostration if we started all over, for if we got out all who are clamoring to be discharged, then we would know the problem before us and go to work to solve it. The uncertainty is debilitating and it is sweeping away the splendid morale which we built up during the war."

One plan adopted is to extend the recruiting for the navy to the ships and make each ship a recruiting station. With this added impetus to the shore recruiting divisions, it is believed a portion of the deficiency in the enlisted personnel will be relieved.—*Army and Navy Journal*, 7/12.

COAST GUARD AND THE NAVY.—The navy wants the Coast Guard to be incorporated with itself, and the Coast Guard personnel are in favor of being thus incorporated. A vote taken last March at a meeting of the commissioned and warrant officers of the Coast Guard showed 59 in favor of amalgamation with the navy and two against. A vote of the entire service gave 339 in favor and four against amalgamation. The navy needs the experienced and well-trained officers and men of the Coast Guard Service to assist in carrying on the heavy duties which have been thrown on the navy by war conditions. Performance of the important coast guard duties affords a school of training in coastal navigation and steamship practice that can be had in no other way.—*Scientific American*, 7/5.

NAVY TO KEEP MANY RESERVE OFFICERS.—The signing of the peace treaty and the expectation that the President will shortly declare the national emergency at an end has aroused general interest among naval reserve officers, and the question is asked whether it is the intention of the Navy Department that all officers in Class 3 be placed on the inactive list at once. Inquiry at the department develops that this is not the intention, and that it is proposed to keep on active duty all the officers the navy can use. Of course as troop movements cease the use for Class 3 officers will diminish and they will be placed on inactive duty as they can be spared. Another question which arises is as to what action will be taken in respect to reserve officers undergoing extended treatment in various naval hospitals, particularly in respect to continuing treatment at such places and their pay. These officers, it is learned, will not be discharged until treatment is completed, except in the case of incurables whose cases would be surveyed and report acted upon in each individual case by the department.—*Army and Navy Journal*, 7/5.

NAVY MEN SERVING OVERSEAS MAY HAVE FAMILIES JOIN THEM.—Secretary Daniels announces that hereafter officers and men of the navy serving overseas will be permitted to have their families join them. The State Department will issue passports for this purpose when the request is approved by the Navy Department. These passports are stamped on the face, "Not valid for return to the United States within a period of six months of date of issue."

The Secretary of the Navy has prescribed the following conditions which will govern:

The officer or man concerned must first submit a request to the senior naval officer present, asking that his family be permitted to join him. If the senior naval officer present approves, he will cable his approval to the

Bureau of Navigation, Navy Department. This approval means that the officer concerned is able to furnish west-bound passage on commercial line provided government transportation is not available and agrees to his family remaining overseas six months; and that in the case of persons other than wife and children the officer or man concerned has submitted a certificate to the effect that the person for whom transportation is asked is a permanent member of his immediate family, habitually resides with him and has no other home. This is required by the law and no transportation can be furnished unless such a certificate is made.

Upon receiving this approval the Bureau of Navigation will endeavor to arrange government transportation to suit the convenience of families concerned. It is most important that the person concerned make request to the bureau for this transportation, advising the bureau of the address, the name, and relationship of all persons composing the family, and in the case of children their ages and date they will be ready for transportation. Communications regarding transportation should be addressed direct to the Bureau of Navigation.

For the present and until the service at large has had time to receive the prescribed conditions, the Bureau of Navigation will undertake to get a cable to the officer concerned upon receiving request from his wife.

Where the above procedure is not followed it is probable that delay will result.—*U. S. Official Bulletin*, 6/16.

SUPPLY CORPS OF THE U. S. NAVY.—The Naval Appropriations Act for 1920 contains a provision changing the name of the Pay Corps of the navy to Supply Corps. This is in line with the General Order issued in 1915 which changed the title of the pay officer of a ship to supply officer and of the general storekeeper and general storekeeper's department at a navy yard to supply officer and supply department, respectively. When the Pay Corps was established practically the only duty imposed upon its officers was the disbursement of money and, consequently, the title of the corps indicated exactly its duties. Gradually, however, new duties and responsibilities were added until to-day the work handled by the officers of the Supply Corps is very diversified, embracing several distinct specialties as follows:

Financial and monetary administration, general supply, transportation, contractural and purchasing, disbursing of money, commissary, cost accounting, military, general executive and administrative. An officer of the Supply Corps is also required to have some knowledge of legal matters. While the financial duties of an officer of the Supply Corps are of course most important, money is after all but one of the many kinds of supplies that he has to furnish and it is in fact the easiest to procure, handle and account for. The work of obtaining provisions and administering the commissary department in general is an equally important part of the professional duties of a supply officer as well as obtaining, issuing and accounting therefor, clothing and small stores for the enlisted men and the thousands of articles of ship's equipment and consumable supplies required.

The name Supply Corps, therefore, more adequately describes the duties performed by its members, and the change will be most welcome to those who have charge of supplying the navy with everything it needs and who did so in such a notably efficient manner during the war with Germany.—*Army and Navy Journal*, 7/12.

CHANGES IN NAVY OFFICERS' UNIFORMS.—In a general order dated June 12, 1919, and approved by Secretary of the Navy Daniels on June 14, it is announced that the Uniform Regulations of the U. S. Navy are amended so as to eliminate eight uniforms from among those heretofore prescribed for commissioned officers, as well as a number of articles of equipment for uniform. The ordinary service uniform during the war

was found to meet the requirements of formal and informal occasions, and will be all that will henceforth be required, Secretary Daniels believes. "This," he said, "will effect economy, both to the officer and in space on shipboard and facilitate ease in traveling from one station to another. It will result in a great saving to the officers of the service in the future, as they are required to purchase all articles of uniform at their own expense." The general order follows:

G. O. 477, June 12, 1919, Navy Dept.

Subject: Uniform.

1. The following garments and articles of equipment of officers' uniform are hereby discontinued:

Special full dress coat
Mess jacket
Full dress trousers
Mess trousers
Cocked hat
Epaulets
Full dress belt

2. The following prescribed uniforms set forth in Chapter 3 of Uniform Regulations are abolished:

Special full dress
White special full dress
Full dress
White full dress
Dress
Evening full dress
Dinner dress
Mess dress

3. For the present there will remain the following uniforms:

Undress. (As specified in Chapter 3 of Uniform Regulations. When medals and badges are worn this uniform will be designated "dress.")

Service dress. (Ribbons of medals and badges to be worn.)

White service dress. (Ribbons of medals and badges to be worn.)

Evening dress.

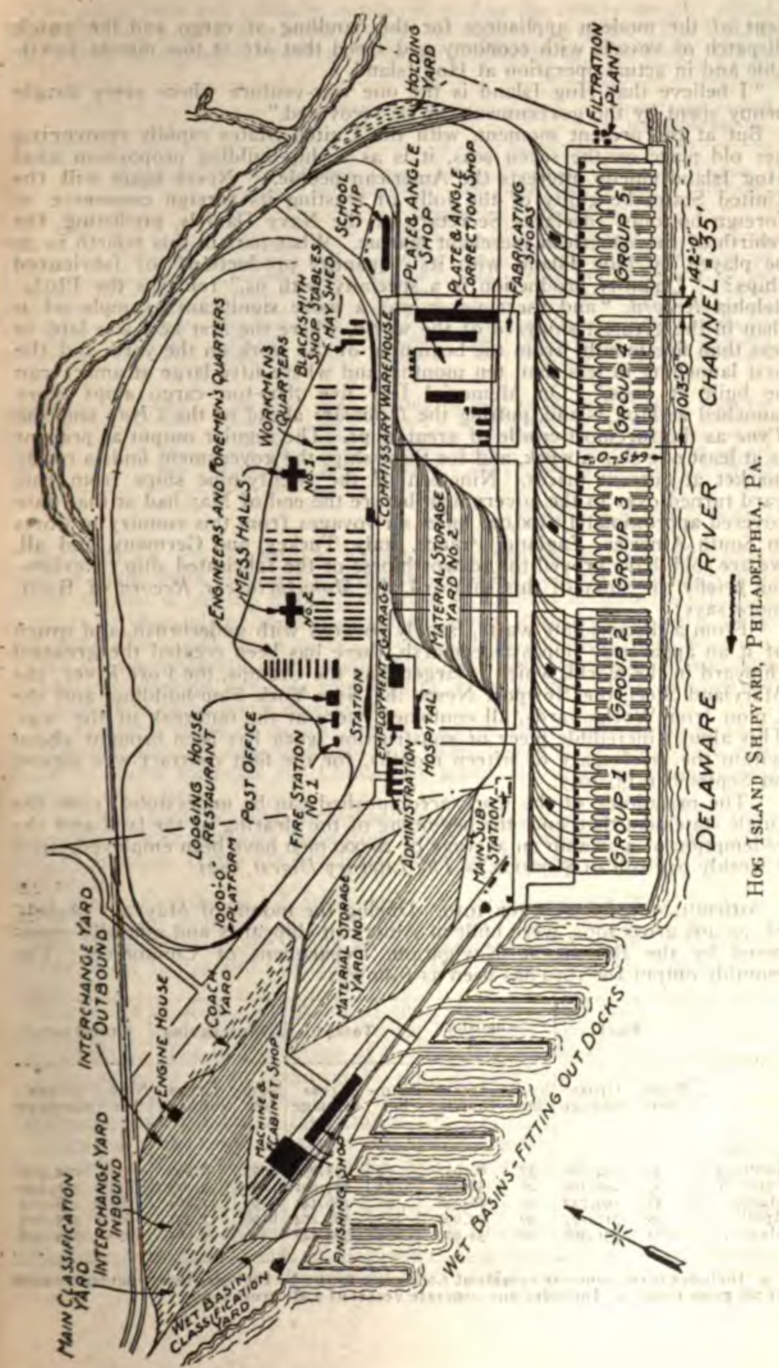
4. Until further orders only the service dress and white dress will be worn.—*Army and Navy Journal*, 6/21.

MERCHANT MARINE

HOG ISLAND VINDICATED.—The Hog Island shipyard, planned and constructed during the war's darkest period to defeat the German menace by building ships faster than the U-boats could sink them, had not delivered one completed vessel when the armistice was signed, and the original estimate of $21,000,000 as the cost of the plant had been more than trebled by January 1, 1919. For a time, moreover, public confidence in this colossal enterprise was shaken, and charges of inefficiency, profiteering, and prodigal extravaganee were hurled against its management. But now that the crisis which called it into being has passed, the greatest shipyard in the world seems to be getting its vindication, and bouquets are replacing brickbats in the news and editorial columns of the daily press. The Philadelphia *North American*, which for a long time maintained a doubting attitude toward this enterprise, now affirms that "the manner in which America uses the opportunity provided at Hog Island shipyard will be a test of her ability to hold her own in the trade of the world and will show to what extent she has the qualities of a great, progressive nation."

In his testimony before Senator Fletcher's committee in January, Mr. Brush said:

"I have no hesitancy in stating to you as a positive fact that there do not exist at any commercial port in the United States any better equipped storage yards and storage houses or piers for commercial purposes. At no other commercial piers in the United States does there exist to-day 50 per



HOG ISLAND SHIPYARD, PHILADELPHIA, PA.

cent of the modern appliances for the handling of cargo and the quick dispatch of vessels with economy and speed that are at this minute available and in actual operation at Hog Island.

"I believe that Hog Island is the one war-venture where every single penny spent by the government can be recovered."

But at the present moment, with the United States rapidly recovering her old place on the seven seas, it is as a ship-building proposition that Hog Island chiefly interests the American people. "Never again will the United States be guilty of the folly of trusting its foreign commerce to foreign bottoms," declares Secretary of the Navy Daniels, predicting the rebirth of the American merchant marine. What part in this rebirth is to be played by Hog Island with its "quantity production" of fabricated ships? "Quantity production is a specialty with us," remarks the Philadelphia *Record*, "and there never was a more significant example of it than in the greatest shipyard of the world, where the first keel was laid in less than five months from the beginning of the work on the yard, and the first launching in less than ten months, and where fifty large steamers can be built at once." On Memorial Day five 7800-ton cargo ships were launched at Hog Island, putting the *Delaware* ahead of the *Clyde* and the *Tyne* as the foremost cradle of great ships. The regular output at present is at least one ship a week, and for these ships the government finds a ready market at current prices. Nineteen of the twenty-nine ships from this yard turned over to the government before the end of May had at that date covered approximately 100,000 miles on voyages from this country to ports in South America, England, France, Italy, Turkey, and Germany, and all, we are told, have proved the seaworthiness of the fabricated ship. Reviewing briefly the story of this shipyard, the *Manufacturers' Record* of Baltimore says:

"From a disconsolate waste, largely covered with underbrush, and much of it an apparently impassable marsh, there has been created the greatest shipyard in the world, which is larger than the Cramps, the Fore River, the Maryland Steel, the Newport News, the New York Ship-building, and the Union Iron Works yards, all combined, were at the outbreak of the war. This almost incredible piece of construction work has been brought about within the brief space of fifteen months, for the first contract was signed on September 13, 1917.

"The magnitude of the work accomplished can be understood from the single statement that since the beginning of the clearing of the land and the redemption of a swamp an average of 26,000 men have been employed, with a weekly pay-roll of $600,000."—*The Literary Digest*, 6/21.

SHIPBUILDING OUTPUT FOR 1919.—During the month of May 250 vessels, of 395,408 gross tons, were built in American shipyards and officially numbered by the Bureau of Navigation, Department of Commerce. The monthly output for 1919 has been as follows:

Months	Steel		Seagoing wood		Total		Nonseagoing		Grand total	
	Number	Gross tonnage	Number	Gross tonnage	Number	Gross tonnage	Number	Gross tonnage	Number	Gross tonnage
1919										
January...	42	174,790	37	80,957	79	255,756	a 53	8,590	132	264,346
February..	47	206,106	26	58,095	73	264,201	62	7,229	135	271,430
March.....	47	199,743	44	86,398	91	286,141	95	11,864	186	298,005
April......	75	316,177	30	52,097	105	368,274	b 96	7,331	201	375,605
May.......	c 84	351,368	20	34,979	104	386,347	146	9,061	250	395,408

a. Includes three concrete vessels of 1,004 gross tons. b. Includes two concrete vessel of 588 gross tons. c. Includes one concrete vessel of 2,481 gross tons.

The ships built and officially numbered during the twelve months ended May 31, 1919, totaled 2157, with a gross tonnage of 3,639,020. The following shows the output for twelve-month period beginning with May, 1918:

12 months ending—	Steel		Seagoing wood		Total		Grand total, including nonseagoing	
	Number	Gross tonnage	Number	Gross tonnage	Number	Gross tonnage	Number	Gross tonnage
1918								
May	232	966,850	151	219,947	383	1,186,797	1,661	1,381,369
June	252	1,031,976	158	215,716	410	1,247,692	1,622	1,430,793
July	275	1,124,066	189	274,330	464	1,398,396	1,610	1,571,572
August	315	1,268,452	214	354,172	529	1,622,624	1,612	1,781,379
September	352	1,411,144	256	465,327	608	1,876,471	1,681	2,013,264
October	396	1,594,927	287	546,613	688	2,141,540	1,760	2,280,111
November	437	1,771,560	331	657,487	768	2,429,047	1,814	2,560,503
December	460	1,861,321	361	735,705	821	2,579,026	1,882	2,721,281
1919								
January	490	1,982,372	392	810,194	882	2,792,566	1,957	2,920,832
February	520	2,094,236	404	850,415	924	2,944,651	2,008	3,074,661
March	538	2,178,939	436	916,037	974	3,094,976	2,056	3,225,521
April	582	2,364,479	451	947,117	1,033	3,311,596	2,092	3,438,076
May	626	2,558,249	458	965,643	1,084	3,523,892	2,157	3,639,020

—*Nautical Gazette*, 6/21.

MORE THAN 350 AMERICAN VESSELS ENGAGED IN FOREIGN COMMERCE NOW SAILING FROM ATLANTIC SEAPORTS.—The big part the American Merchant Marine is playing in the promotion of trade is indicated by the vast number of ships plying the various trade routes from Atlantic ports carrying American goods to all parts of the world in American bottoms.

Out of four Atlantic ports alone 1,172,704 deadweight tons of shipping, embracing 221 ships, are now employed in spreading the fruits of American ingenuity and commercial enterprise.

To the west coast of South America six of these ships totaling 23,295 deadweight tonnage now regularly sail. Nine of the ships from these ports leave at stated intervals for China and Japan, representing a deadweight tonnage of 74,596.

Australia, New Zealand, New Guinea and Africa we are in direct communication with through these four ports. Six steamers of total deadweight tonnage 42,590 are employed carrying cargoes from and to those countries.

In the trans-Atlantic, Mediterranean and South Europe trade there are 13 of the ships employed of 91,120 total deadweight tonnage.

One hundred ships are plying from these four ports north of Baltimore to the West Indies and Caribbean trades, totaling 319,592 deadweight tonnage.

There are 24 ships sailing out of these four Atlantic ports employed in carrying on trade relations between the east coast of South America and this country. The total tonnage of these vessels is 166,082 deadweight.

Five ships of 37,429 deadweight tonnage are now sailing from these four American ports in the trade routes of Levant, Indian, Ocean-Straits Settlement and the Dutch East Indies.

Engaged in the trade routes of the Trans-Atlantic and Northern Europe there are 50 ships sailing from these four Atlantic ports with a total deadweight tonnage of 373,146.

The four Atlantic ports from whence all the above tonnage moves are Boston, New York, Wilmington, N. C., and Philadelphia.

Sailing from ports south of Baltimore, including that port, are 161 vessels with a total tonnage deadweight of 697,807.

Ten of these ships, 35,834 deadweight tonnage in all, ply between these ports and the west coast of South America. One ship of 11,086 deadweight tonnage links up with China and Japan. There are six vessels plying the trans-Atlantic Mediterranean and South Europe trade routes with a tonnage deadweight totaling 37,297.

Thirty-four of the vessels aggregating 102,243 deadweight tonnage ply between the United States, the West Indies and the Caribbean. There are 35 vessels with a tonnage totaling 163,191 deadweight, engaged in trade between the United States and the east coast of South America sailing from these ports.

In the trans-Atlantic and Northern European trade routes 40 vessels of 230,160 total deadweight tonnage are regularly plying from ports south of Baltimore and that port.—*United States Bulletin*, 6/23.

America's Merchant Fleet Costs $180 Per Deadweight Ton.—In submitting a request for $673,368,301, with which to complete the government shipping program, Chairman E. N. Hurley, of the United States Shipping Board, disclosed that the cost of America's new trading fleet will be $180 a deadweight ton.

The program contemplates the construction of 2434 vessels aggregating 13,885,106 deadweight tons. While on this basis the cost would appear to be $206 a deadweight ton, the chairman calls attention to the fact that rebates in income and excess profits taxes by the shipbuilders amount to approximately $347,127,650, which he contends can legitimately be considered as reducing the cost to $180. The rebates, he adds, do not take into consideration the taxes paid by the hundreds of subcontractors who manufactured the steel, the boilers and other equipment.—*Engineering World*, 6/15.

NAVIGATION AND RADIO

The Astronomical Day.—The movement in behalf of making the astronomical day begin at midnight, so as to coincide with the civil day, has borne fruit in Great Britain, where the Admiralty has just given instructions to have this reform adopted in the British Nautical Almanac, beginning with the issue for 1925. This step was taken after consultation with the Royal Astronomical Society, which, in turn, consulted the superintendents of the ephemerides issued in other countries and various other astronomical authorities. According to *Nature* the change is made mainly for the benefit of seamen.—*Scientific American*, 6/21.

Wireless Direction Finding.—The operation of wireless direction-finding apparatus depends on the fact that a closed or nearly closed high-frequency oscillating circuit has an asymmetry of radiation or absorption. The circuit radiates or absorbs wave energy best in its own plane. Therefore by rotating a nearly closed antenna round a vertical axis it can be used with a suitable detector to determine the direction of a sending station. When the sounds in the detector are at a maximum the direction of the source of the waves is in the plane of the aerial. The closed or partly closed circuit antenna has, however, less radiating or absorbing power than an open circuit antenna, and also the movement of aerials of any size in this manner is scarcely practicable. In actual work this somewhat obvious method is therefore confined to the few special cases in which small aerials wound on frames will suffice. The direction-finding system which has been developed by the Marconi Company and which was used for the present demonstration overcomes this disadvantage, as it permits the use of relatively large stationary aerials. In this system two independent triangular or rectangular aerials are erected with their planes at right angles to each other. A small closed detector circuit is coupled inductively to these two antennæ and rotated until the sounds in the detector are a maximum. When this is the case, it can be shown that the

plane of the detector coil lies in the direction of the incident waves. Two such stations, a known distance apart, can therefore accurately determine the position of an unknown station sending out signals, and similarly one station equipped with this apparatus could locate its own position by reference to two other known stations. This development in wireless work was applied to considerable advantage during the war, and it clearly possesses great possibilities in connection with navigation by sea and air.—*The Engineer*, 6/6.

MARCONI'S DEVICE FOR ENDING COLLISIONS AT SEA.—The part played by wireless telegraphy has become so universal that familiarity has bred indifference towards something our grandfathers would have hailed as a miracle. No one can estimate the value of wireless to the maritime world, and this value is forever increasing. But even greater things are promised the shipping world in Senator Marconi's latest invention. This new discovery provides a means whereby a ship in the densest fog can distinguish the approach of another ship equipped with a similar apparatus, and at the same time obtain an approximate idea of the distance of the approaching ship. The invention is an accomplished fact, and the company is now perfecting it in a practical and commercial form. If all ships were to carry this appliance, there would be no more collisions at sea.—*Nautical Gazette*, 7/12.

RADIO COMPASS STATIONS.—Vessels desiring to obtain a bearing from compass stations which operate independently should call the station from which the bearing is desired and request bearings by means of a conventional signal. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired.

Vessels desiring to obtain their positions from harbor-entrance compass stations should carry out the same procedure, with the exception that they call the compass-control station instead of the compass station.

When bearings are requested simultaneously from two or more independent compass stations, the compass station which is farthest north will supply the ship with its bearing first; the others will then follow in the order of their north to south, or east to west, geographical location.

The vessel acknowledges receipt of bearings and positions by making the call letters of the station transmitting the bearing or position once, "DE," vessel's radio call letters, and then repeats the bearing or position received, using numerals.

Independent radio compass stations keep watch on 600 meters, and this wave length should always be used to call these stations; but as soon as they answer naval vessels will shift to tune "M" (952 meters), all transmission from the vessel being carried out thereafter on this wave length.

The control stations for harbor-entrance radio compass stations keep watch on 600 and 952 meters. Naval vessels will call these stations on 952 meters and carry out all tests and communication with them thereafter on 952 meters.

Merchant vessels will call all radio compass and compass-control stations on 600 meters and carry out all tests and communication with them thereafter on this wave length.

Vessels should note that shore radio compass stations cannot distinguish between the bearing of a ship and its reciprocal unless the reciprocal bears inland. There is, therefore, a possibility of an error of 180 degrees; in such cases the decision is left to the ship as to which is her correct bearing.

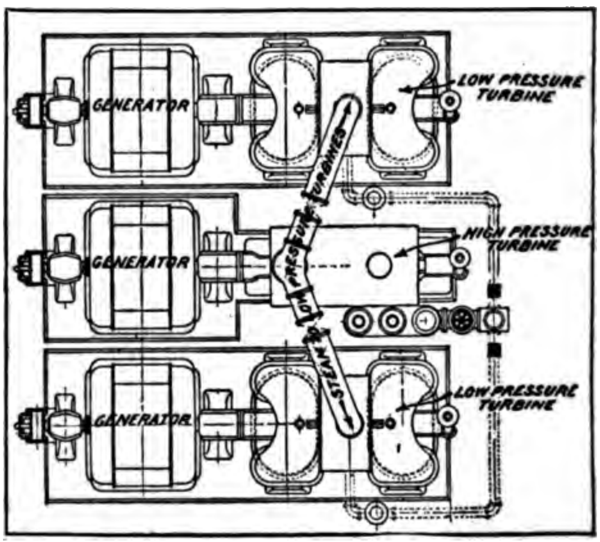
Subject to the foregoing, bearings should be accurate within 1 degree of arc. When bearings from three or more compass stations are not over 1 degree of arc in error but do not meet at a fixed point, the center

of an area inclosed by the bearings can generally be taken as the approximate position of the vessel.

The primary object of these radio compass stations is to assist in the navigation of vessels during atmosphere of low visibility. They are operated by the Navy Department, and there is no charge for the service.—*Hydrographic Bulletin*, 6/18.

ENGINEERING

ONE HUNDRED THOUSAND HORSEPOWER STEAM TURBINE.—*From Piston to Turbine—Reconstruction of a Great Power Station.*—In the *Scientific American* of January 11, 1902, there was published an illustration of one of the eight great reciprocating steam engines which had just been completed at the new 74th Street power station of what was then the



PLAN VIEW OF THE TRIPLE-COMPOUND TURBINE.

Manhattan Elevated Railway Company. Each unit had a normal capacity of 8000 horsepower and a maximum of 12,500 horsepower, and each consisted of two compound condensing engines, coupled to a common shaft, with an alternator mounted on the shaft between them. The 44-inch H. P. cylinders were placed horizontally, and the 88-inch L. P. cylinders vertically, the two connecting rods of each engine taking hold of a common crank pin. The huge rotating field, 32 feet in diameter, weighing 185 tons, served as a fly wheel. Each pair of engines weighed 720 tons.

The maximum possible output of the eight steam units with which the building was fitted was 100,000 horsepower.

There has recently been installed in the same plant a single triple-compound Westinghouse steam turbine which has a maximum output exactly equal to the maximum output of eight units, including sixteen compound engines, that previously fitted the engine room.

With the development of the steam turbine, especially in the larger sizes, the economy both in floor space and bulk and in steam consumption of the turbine, was so marked that it was only a question of time

before such large reciprocating engines as those in the 74th Street power house would be replaced by the more modern prime mover.

This substitution has been taking place during the past few years. Not only have the reciprocating engines of large power stations throughout the country been gradually taken down and turbine units erected in their place, but there has been a notable increase in the power of these individual units themselves. The first turbines to be installed at the 74th Street plant were of the compound type with high and low pressure elements. Each of these was direct-connected to two generators, there being one generator on the high pressure and one on the low pressure shaft. The maximum output of each unit was 30,000 k. w. These units are shown in the lower left-hand view.

There has recently been completed the great turbine referred to above, which is remarkable as being the most powerful steam engine in the world. It consists, as can be seen from our photograph, of a central high pressure turbine and two outer low pressure turbines. Each turbine is direct connected to its own generator. The steam is led to the high pressure element at 205 pounds pressure to the square inch. After it has passed through, it is led by a bifurcated steam pipe to the low pressure cylinders, as shown in the accompanying diagram. It enters at the center and the steam flows in opposite directions through the successive rows of blading. From the low pressure turbine it passes to the condensers which operate under 29 inches vacuum.

The speed of rotation is 1500 revolutions per minute and at this speed with 205 pounds pressure at the throttle this wonderful engine has a total horsepower of about 100,000 and the total output from three generators which it operates is 70,500 k. w. The generators are each rated at 20,000 k. w. continuously and they have a maximum output of 23,500 k. w. for two hours. Twenty-five cycle current at 11,000 volts is delivered from the main power house to the sub-stations. The floor space covered by the big turbine is 52 by 50 feet and its height is about 20 feet. When the turbine is running at maximum load, 826,000 pounds of steam pass through the blades of the turbine per hour, and the water rate is less than 11 pounds of steam per kilowatt hour.—*Scientific American, 6/21.*

NEW DIESEL-STILL ENGINE QUESTIONED.—*Its Practicability and Economy Yet to be Demonstrated.*—It is common knowledge that the internal-combustion engine has a higher thermal efficiency than the steam engine, says *London Engineering*. It converts a greater proportion of the heat in the fuel which it uses into useful work, and this greater proportion is by no means trivial in amount. In many forms the internal-combustion engine is also an entirely practical proposition. These things are admitted on all hands, and yet, in spite of growing fuel costs, the internal-combustion engine fails to eliminate the steam engine and for the larger powers fails even to keep up with it. It is only in special fields in which its peculiar attributes are not objectionable, or are even virtues, that the internal-combustion engine holds its own. The reasons for this position of affairs briefly are that the internal-combustion engine cannot start without some external source of power, that it cannot develop its full power except at full speed, that it is a poor performer at low speed and can carry but little overload. Also it may cease to operate without warning. A further consideration is that when large powers are reached great practical difficulties are encountered in construction. It appears probable that if the internal-combustion engine is to become a serious rival to the steam engine—which in this connection may be read steam turbine—for large powers then this last consideration in particular must be overcome.

In a paper read before the Royal Society of Arts, Captain F. E. D. Acland described an engine which has been developed by Mr. W. J. Still, and which represents an attempt both to improve the efficiency of the

internal-combustion engine and to eliminate some of its undesirable characteristics. Briefly, the Still engine is an internal-combustion engine, the cylinder of which is jacketed with hot water at constant temperature. Heat abstracted from the combustion cylinder is employed not in raising the temperature of the jacket water, but in converting it into steam. The jacket is connected up to the water space of a steam boiler and this water, on its journey to the jacket, is taken through a tubular heater through which the exhaust gases pass. The steam and water leaving the jacket are led to the steam space of the same boiler. The exhaust gases, on leaving the tubular heater are taken through a second heater, through which the feed water is drawn. The steam from the boiler is used in a steam cylinder which forms the underside of the combustion cylinder. That is to say, there is but one piston and one cylinder, the upper part of which is an internal-combustion cylinder and the lower part of which is a steam cylinder. The down stroke is an internal-combustion stroke, and the up stroke a steam stroke. For the sake of clarity we have described the engine in its simplest form, but naturally there may be more than one of the combined cylinders, and part of the steam may be used in separate cylinders, compounded or otherwise.

Remarkable economies are claimed for this engine, and theoretically they may be admitted. It is stated that a final exhaust temperature as low as 150 deg. F. is obtained, so that the working temperature range is very large. The arguments for economy are based on the following main considerations: The high jacket temperature results in a higher mean temperature than usual in the combustion stroke, which improves efficiency. All heat rejected to the jacket is recovered directly as steam and not in the form of hot water difficult to use effectively. The steam cylinder, it is claimed, gives unusually good results, since as the cylinder is preheated by the combustion stroke there is no condensation and the steam is rejected to exhaust slightly superheated. From an operating point of view it is claimed that as the steam warms the engine before starting there are no sudden temperature changes, and that the steam allows the engine to be started against load. In Still-Diesel engines it is further claimed the compression pressure may be reduced by 50 per cent with entirely reliable ignition, owing to the higher mean temperature of the cylinder. This simplifies constructional difficulties.

The engine is a very interesting one and it is to be hoped it may be developed and become of importance, but it would appear that it will have to demonstrate its practicability in a very definite way before it can be unreservedly accepted. Confining ourselves for the moment to large sizes, it will be interesting to consider how the engine compares with, say, a large gas engine. Such engines have partially failed, and are failing, to make way on the score of practical considerations and we fear it is not clear that the Still engine, accepting its qualifications on the reports of its sponsors, eliminates the points which in large gas engines have given trouble. It might not unreasonably be suggested that from this point of view the Still engine introduces new ones. Clearly it is a complicated machine, and the main cylinder troubles of a large gas engine would appear to be retained. It must be admitted, however, that the high efficiency claimed makes the large gas engine better worth fighting for than ever.

We have no wish to take up an attitude of opposition on the question of the mechanical running of the engine. Indeed we would be precluded from doing so, even if we wished it, from the fact that unfortunately little or no practical detail was described in Captain Acland's paper. The only feature on which a detail of construction was included was in connection with the cross-section of the cylinder and jacket. The cylinder proper, in, for instance, a Still gas engine, is made of metal approximately one-third, or one-fourth, of the usual thickness. It is ribbed on

the outside to increase the surface in contact with the jacket water. The ribs are machined on their outer ends and the whole is enclosed in a steel outer cylinder which forms the jacket, and at the same time supplies the necessary strength to enable the cylinder to stand up to the internal stresses. It is stated that no failure of a cylinder has ever occurred. It is particularly claimed in connection with this construction, and in view of the fact that the jacket water is of constant temperature throughout, that stresses in the cylinder, due to cold water at the inlet and hot water at the outlet, met with in ordinary cylinders, are suppressed in the Still engine. There is possibly something in this, but none the less a uniform wall temperature is hardly likely to be achieved, while the high mean temperature would appear to suggest lubrication difficulties.

DESTROYER SPEEDS.—The United States destroyer *Cole*, built under the War Emergency Programme and understood to be of the flush-deck type, has covered a five-mile course on the Delaware River at a mean speed of 41.1 knots. This figure, if confirmed, would constitute a world's record, and official verification will therefore be awaited with interest.—*The Engineer*, 6/27.

MELTING METAL ELECTRICALLY.—"Offhand, one would be tempted to say that the complex transformation of energy from fuel to electricity and back again to heat, as required for electric furnace operation, would involve such economic disadvantages that it could not be considered as a commercial proposition. However, brass furnaces, even more than steel furnaces, are showing their economic value in permitting better quality of product, minimizing metal loss, and reducing amount of labor. Furthermore, the temperature is under precise control and the furnace atmosphere is free from contaminating gases and may be made reducing, neutral or oxidizing. These are particularly important points in the melting of non-ferrous alloys because on them depend the metal loss and quality of the product. The gas absorption is materially less than in fuel-fired furnaces, so that more homogeneous metal exceptionally free from blowholes can be obtained. The actual cost of melting brass per ton is considerably less with the electric furnace and energy at 1.5 cents per kilowatt-hour than with gas, coal, or coke furnaces at the present prices of fuel. What is true of brass is to a certain extent true of many other alloys, especially those in which there is considerable difference in the melting and volatilization temperatures of the constituents. In not a few cases the ability to work in neutral or reducing atmosphere is vital to the successful production of alloys."—*The Literary Digest*, 7/12.

THE ATLANTIC FLIGHT.—From the purely technical point of view the successful flight performed by Captain Alcock and Lieutenant Brown in the Vickers "Vimy" biplane is chiefly interesting as an indication of the progress which has been made in the trustworthiness of aeroplanes and aero-engines. While we have to congratulate the crew upon their skilful handling and navigating of the machine, we must equally congratulate Messrs. Vickers and Messrs. Rolls-Royce upon the undoubtedly fine achievement of their aeroplane and engines respectively. Some idea of the perfection of detail which a flight of this nature implies to have been reached may be gathered from a few figures relating to the work done by the engines during the passage of fifteen hours and fifty-seven minutes. The engine speed being 1800 revolutions per minute, each of the two engines made approximately a total of 1,728,000 revolutions. Each piston travelled up and down its cylinder an aggregate distance of 352 miles, and as there are twelve cylinders per engine the total piston travel reached 8448 miles. On each engine the valves were operated altogether 20,736,000 times, and a like number of sparks were supplied by the mag-

netos and plugs, there being two plugs per cylinder. From the point of view of the aeroplane itself the most interesting figure technically is the high average speed maintained throughout the flight, namely, 117½ miles an hour. When we reflect that on a railway journey between, say, London and Glasgow, the locomotive is changed some three times, and the carriage tires are tested—though possibly unnecessarily—even more frequently, we realize in some degree the faith that is involved in an aeroplane flight of nearly sixteen hours at a speed twice that of an express train. Pilot and navigator were exhausted, as well they might be, but the aeroplane and its engines were at the end of the flight apparently still full of life, and but for damage done to the machine as a result of landing at Clifden in a bog, they might have flown still further without replenishment or inspection. Truly a remarkable testimony to the skill of British aeroplane and aero-engine designers and workers.—*The Engineer*, 6/20.

AERONAUTICS

BRITISH DIRIGIBLE "R-34" SUCCESSFULLY TRANS-NAVIGATES ATLANTIC FROM SCOTLAND TO UNITED STATES.—The British dirigible *R-34* arrived at Roosevelt Field, Mineola, L. I., at 8.45 o'clock in the morning of July 6, circled the field three times to make observations, and at 9.21 o'clock the first overseas air pilgrim, Major John Edward Maddock Pritchard, landed upon American soil, after a parachute drop of 2000 feet.

This completed the longest flight in history, the distance covered being 3200 miles, not counting the mileage forced upon the flyers by adverse winds. The time consumed was a few minutes more than 108 hours. The big airship brought over thirty-one persons, one of whom was a stowaway, and a tortoise shell cat.

The *R-34* was built for the British Admiralty at the airship works of Wm. Beardmore & Co., Ltd., Inchinnan, Renfrewshire, Scotland. The ship is about 670 feet long by 80 feet in diameter, and it has a capacity of more than 2,000,000 cubic feet, with a useful lift of over 30 tons. She is fitted with Sunbeam-Cossack engines and capable of attaining a speed of about 70 miles per hour. The ship's complement numbers about 30.

The *R-34* is one of the two largest dirigibles in the world. Although the construction of the two dirigibles had been in progress at Inchinnan, near Glasgow, for months before the end of the war, it was not until last February that the Admiralty admitted that it had plans for airships even larger than the German Zeppelins.

The *R-33*, equipped as an aerial battle cruiser, had her trial flight about March 1, and her sister craft took to the air a few days later. It was announced on March 22 that the war equipment of the ships would be partly dismantled and that they would be prepared for a flight across the Atlantic.

It is an open secret that the large rigid airships, *R-33* and *R-34*, do not represent the last word of the Admiralty in this branch of aeronautical effort. There are in hand at the present time at least four other rigid airships of greater size than the *R-34*, representing a distinct step in advance of any already produced, and it is understood that their completion is hoped for by the end of the year.

The secret of successful long distance flying lies mainly in the efficiency and reliability of the engines, which, in the case of the later rigid airships built or building for the Admiralty, are of Sunbeam-Coatalen design. The *R-34* is fitted with four 350 "Cossack" type engines, whilst the two others in addition to having a similar number of "Cossack" engines are equipped with two "Maori" engines of 250 h. p. each, making a total of 1900 h. p. for each airship. Such figures of engine power in comparison with that obtained in the early days of aviation, when perhaps a 20 h. p. engine was the sole unit, are staggering, but it is safe to say that even now the limit of engine power has not been reached. A very high degree

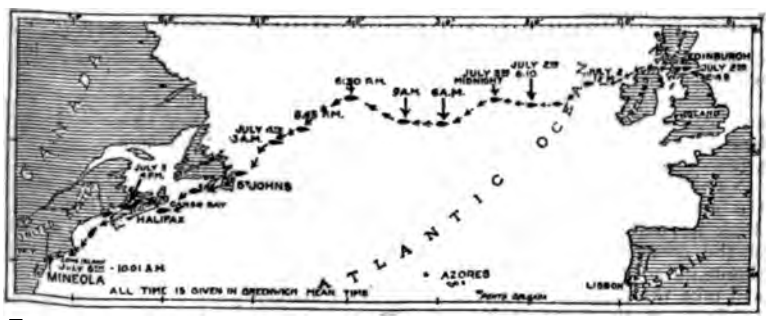
of general efficiency and power maintenance over long periods has been attained for some time past by Sunbeam engines, which possess a reputation second to none.

The Sunbeam Maori engine is of the 12 cylinder, 60°, water-cooled, "V" type, rated at 250 h. p. At ground level the b. h. p. at 2100 r. p. m. is 265 and at 2200 r. p. m., 280. Bore, 3.93" (100 mm.); stroke, 5.31" (135 mm.). Bore and stroke ratio, 1.08 to 1. The mean effect of pressure in pounds per square inch is 128. Compression ratio, 3.6 to 1.

There are four valves per cylinder, two inlet and two exhaust. Inlet valves have a lift of .3543" and exhaust valves a lift of .3500". The firing order of the cylinders is as follows: 1-5-3-6-2-4.

Either four Siemens or four W. B. G. Magnetos are used. The W. B. G. Magnetos each weigh 19.1 pounds and their speed × engine speed is 1.5. K. L. G. or C. B. spark plugs are used.

Two gear type oil pumps, one centrifugal water pump and one plunger type air pump are provided. Four C. H. B. Z. S. 42 mm. carburetors are used.



THE ROUTE OF THE "R-34" FROM EAST FORTUNE, SCOTLAND, TO MINEOLA, A JOURNEY OF APPROXIMATELY 3200 MILES, MADE IN 108 HOURS.

The ratio of gear reduction is 2 to 1 in the "Maori" aeroplane engine, and the propeller is run at one-half engine speed, but in the airships *R-33* and *R-34*, the propellers are driven direct.

The engine complete weighs 830 pounds. Fuel is consumed at rate of 139 pints per hour and oil at 6.5 pints per hour.

The overall dimensions of the Sunbeam "Maori" are as follows: Length, 55.11"; width, 35.46"; and height, 33.85".

When the Air Ministry began to discuss the ocean flight it was planned that one of the ships should take a northerly course and the other should proceed to America by swinging to the south. In dismantling the war equipment, however, it was found that there was too much work to do on the *R-33* to prepare her for the flight, and it was decided that only the *R-34* should be remodeled. In carrying out this plan the Admiralty formally took over the dirigible from the Air Ministry about May 30 and sent her out on a series of practice flights. The ocean flight was held up by the uncertainty preceding the signing of the Peace Treaty, and the airship took a test flight toward Germany.

The length of the vessel is equal to that of a good-sized ocean liner, and she has a beam of 79 feet, making her almost as wide as some of the large ocean-going ships. From the bottom of her lowest gondola to the top of her gas-bag is about 92 feet. She has five cars, or gondolas, suspended from her framework, and all are connected by an immense platform about 600 feet long.

A wireless set in the forward gondola has a range of about 1500 miles and will be used in enabling the captain to direct his course if the sun and stars are obscured.

The airship weighs about 30 tons, and its useful load is about 20 tons, according to Colonel Lucas. According to the same authority it displaces about 60 tons of air.

Major G. H. Scott, the commander of the *R-34*, described the trip as follows:

"The voyage was a very enjoyable and most successful one. The total mileage was 3200, and we covered that distance in 108 hours and 12 minutes. The thunder squalls we encountered on the way across caused the delay.

"We will leave for home on Tuesday morning about daybreak. We may start around eight o'clock. That is not settled definitely yet, and much depends on the atmospheric conditions.

"We are not certain whether we will go to Washington and Philadelphia, but probably will not. We are planning now to make a flight over New York City before we take out across the ocean. We may go back by way of Boston.

"The return trip, I think, will not take more than 70 hours. Of course it will not be so difficult, as we will have the wind with us and probably will meet better weather conditions.

"Coming over we had a crew of 30 men and one stowaway. Not one man suffered any kind of illness. We were all in fine shape when we landed at Roosevelt Field. But we had only enough gasolene to operate a few more hours, and you can see we were very fortunate.

"The stowaway will not make the return trip, but will be left here. He probably will be court-martialed in the near future, but I do not think he will be subjected to any severe punishment. The only change in the crew on the way back home will be the addition of Lieutenant Commander W. A. Henssley, of the United States Naval Air Service, who will take the place of Commander Zachary Lansdowne.

"Some of the time we were flying as low as 400 feet above the ocean. At other times we were as high as 6000 and 7000 feet. The altitude varied greatly. All the way over it depended on the wind. We had to keep changing our altitude with the changes in the weather. We encountered strong winds and used five engines, and then at times when the weather was real good we only used two engines. We ran out of gas sooner that we expected because of the strong winds.

"Had the heavy wind over the Bay of Fundy continued through the night we would have been forced to land near Boston. We would not have been able to have made Mineola. The change in the wind came early this morning and it was then that I decided that we could reach Roosevelt Field. I ordered the course changed then.

"We had only four ticklish moments on the way over. Those were during the thunder squalls. They were not serious, however. The only thing that we really feared during the storm was damage to the frame or rudders."—*The Aerial Age Weekly*, 7/14.

NEW ALTITUDE RECORD.—On May 28 last Adjutant Casale, a French aviator, in a flight for altitude ascended 31,000 feet. This constitutes a world's record, being 500 feet better than the flight of Captain Lang, of the British Army, who in January last ascended to 30,500 feet.—*Scientific American*, 6/21.

NAVY HAS 1000 FLYING BOATS AND 700 TRAINING PLANES.—Washington, D. C.—According to statements made by Captain Craven, of the House Military Affairs Committee, the flying equipment of the Navy Department consists of 1051 large flying boats and 763 school planes.—*Aerial Age Weekly*, 6/16.

THE FIRST GOVERNMENT PEACE-TIME ORDER for airplanes has been placed by the U. S. Navy Department with a New York corporation for the immediate delivery of six special Loening monoplanes which are to be used by the Navy Department for shipboard observation use. Recent experiments started just prior to the close of the war, and continued for several months thereafter, have disclosed the remarkable efficiency with which fast high-powered airplanes can be used by the navy for observation and spotting of gun fire of the battleships. The Loening monoplane, a new type of two-seater fighter, which was designed by Grover C. Loening, former chief aeronautical engineer of the Army Air Service, was accepted by the government just prior to the armistice, and after official tests was found to be the fastest and best performing two-seater fighter in the world. Several records for speed and altitude have been broken in the official trials by Major R. W. Schroeder, of the Army Air Service. The machines for the U. S. Navy will be so equipped as to permit of launching off the deck of a ship, as it has been found that the light monoplane type of machine can be accelerated very quickly particularly when equipped with a motor as powerful as the 300-horsepower Hispano-Suiza, which is being used on this type of aircraft.—*Scientific American*, 7/12.

OUR NEW AIRCRAFT INSIGNIA.—The new design for all American aircraft shall soon be a red circle inside of a white, five-pointed star, inside of a blue circumscribed circle. The circumference of the inner circle shall be tangent to the lines forming a pentagon made by connecting the inner points of the star. The inner circle shall be red, that portion of the star not covered by the inner circle shall be white, and that portion of the circumscribed circle not covered by either the inner circle or star shall be blue; the colors to be the same shades as those in the American flag. These insignia shall be placed on the upper and lower surfaces, respectively, of the upper and lower planes of each wing, in such position that the circumference of the circumscribed circle shall be tangent to the outer tips of the planes. One point of each star shall be pointed forward and unless otherwise specified the diameter of the insignia shall be 60 inches. The mark for the rudder shall be three equally wide bands of red, white and blue and both sides of that portion of the rudder which are in the rear of the rudder post shall be striped parallel to the vertical axis of the airplane. The blue band shall be nearest the rudder post, the white band in the center, and the red band at the rudder tail.—*Scientific American*, 7/12.

VISIBILITY OF THE AIR PLANES.—With field glasses an airplane may be seen for distances up to 18 to 20 miles in France and the western United States, and up to 7 to 10 miles on the Atlantic coast of the United States.

An airplane may be heard long before it becomes visible.

It is obvious that visibility conditions depend on the clearness of the atmosphere and on light conditions.—*Liason*, 6/21.

NEW INSTRUMENTS FOR OCEAN FLIGHT.—Before the recent achievements in overseas aerial navigation, no airplane had ever flown far enough out to sea to warrant the use of the sun, moon, and stars for fixing a geographical position, as is done on seagoing ships. Navigation, therefore, on a trans-Atlantic flight was new and untried, and it was necessary in preparing for this flight to design three new instruments for navigational use: 1. An aerial sextant; 2. A drift- and speed-indicator; 3. A course- and distance-indicator. These are described in an article contributed to *Automotive Industries* (New York, May 22). Says this paper:

"A feature of the aerial sextant, known as the Byrd sextant, invented by Lieut. R. E. Byrd, is that a bubble in a tube takes the place of the sea

horizon and observations. . . . This is of especial value, as the aviator is often above the clouds, and even when flying at low altitudes the horizon is too dim to be seen clearly. With this new aerial sextant the curvature of the earth does not have to be taken into consideration in calculating position. The bubble is lighted at night, so that night observations may be taken.

"New methods of astronomical calculations also have been devised which enable the navigator to make his calculations in a fifth of the time that was formerly necessary. A zenithal projection-chart of the Atlantic Ocean has been specially constructed for this purpose. This chart, a new invention, does away with difficult mathematical calculations, enabling the aviator to determine his position in a few minutes.

"Another great problem of the sea-air navigator is the calculation of the speed and direction of the wind, both day and night. In spite of the reliability of the compass, it can only give the course upon which the craft heads, and in determining the true course, proper allowance must be made for the sidewise drift caused by the wind. For example, a wind blowing 30 miles an hour toward the side of the plane will blow it 30 miles an hour out of its course. This fact alone makes the navigation of the air far more difficult than the navigation of the sea.

"To overcome this difficulty, bombs have been invented which ignite upon striking the surface of the water and give a dense smoke and bright light for ten minutes.

"An instrument is used in conjunction with this bomb which enables the navigator to determine the velocity and direction of the wind by sighting on the smoke in the daytime and the lights at night. This instrument has proved successful.

"When the navigator has found the speed and direction of the wind, he must then be able to calculate the course to steer toward the Azores to allow for this wind. To do this, an instrument has been designed to solve the triangle of forces, thus doing away with cumbersome mathematical calculations.

"The navigator also has instruments which show him the altitude of the plane and the time the sun keeps with the Greenwich meridian, because in going to the eastward so rapidly it is difficult to keep the correct time. In going from Newfoundland to the Azores, over two hours are lost in a period of 20 hours, so that the navigator must be very expert in order to allow for this loss in time in making his astronomical calculations.

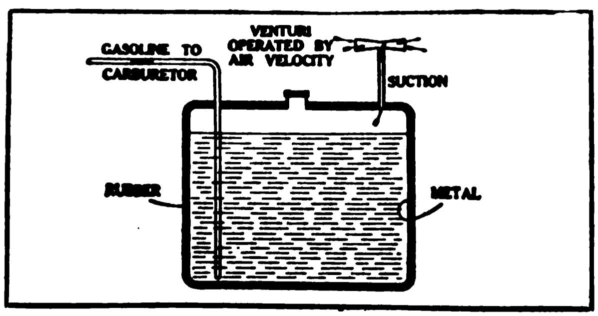
"In aerial navigation, positions must be determined very quickly. The navigator sits down to work out his 'sights,' to fix his position, and by the time he arrives at results he will be far from his calculated position unless he works out his calculations very rapidly, which these instruments enable him to do."—*Literary Digest*, 6/28.

RIGID DIRIGIBLES AND THE U. S. NAVY.—The proposed initial outlay by the U. S. Navy of approximately $13,000,000 for rigid lighter-than-air craft, of the so-called Zeppelin type, is a move that is founded on sound principles, as it will increase the efficiency of our fleets by giving them increased and necessary facilities for spotting and scouting in battle and in convoy work during war. In considering the navy's plans it is well to keep in mind the peculiar usefulness of the rigid dirigible to the United States. The fine weather generally prevailing in the Pacific and in the Caribbean, together with the great areas over which scouting would have to be carried on in the event of war, would give to the rigid airship a value almost inconceivable. Indeed, it is difficult to see how observations over these vast regions could be covered as successfully by means other than through the agency of aircraft. They are now the eyes and ears of a fleet.—*Army and Navy Journal*, 7/5.

SMOTHERING A FIRE BENEATH A COMBUSTIBLE BLANKET.—Inventions of military importance which were held secret during the war are now being made public, and we may read of what American inventors have accomplished in their endeavor to bring about a victorious peace. One invention that demands particular attention is a gasoline tank which will neither leak nor explode, though it be pierced by repeated bullets.

The need of such an invention in aerial combat is obvious. When machine guns were first mounted on planes, the fighters quickly realized that the vital spot to be aimed at was not so much the pilot as the tank, which offered a much larger target. Once a hit was made here, either loss of fuel forced a premature landing, or the leaking gasoline when mixed with the current of air formed an explosive combination which ignited from the engine and set fire to the machine in mid-air.

Armor-plated tanks and compartment tanks to meet this were in turn rendered ineffective by means of armor-piercing and incendiary bullets. The tracer bullet, leaving a fine trail of smoke, guides the gunner's aim; the armor-piercer puts a hole in the tank; the fuel spills out and is ignited by the incendiary bullet. The three varieties of ammunition were fired



THE TANK THAT WILL NOT LEAK OR BURN.

alternately from the one gun, the magazine of which was loaded in advance, the order and number of the three types depending upon the errand to be undertaken. The compartment tank was now also useless, because the heat in a burning or exploding compartment fired the adjoining ones; while the use of a flowing elastic compound for tank walls minimized the tear in the tank walls but gave small protection against the incendiary bullet. The latter functions through the presence of phosphorus, which when mixed with the atmospheric oxygen of the air, will ignite any explosive mixture that comes in contact with it. To get an idea of the vicious character of these bullets, cases can be cited where some of the phosphorus became imbedded in tank walls beneath the fuel level; innocuous for the moment because not exposed to the air, this charge would bring on an explosion hours or days afterwards when the fuel level fell below its hiding place.

This was the state of affairs when the United States entered the war. The problem was taken up by the Bureau of Standards, and the invention of Mr. F. Weinberg, a Detroit automotive engineer, was demonstrated in Washington in August, 1917. Through the co-operation of the Bureau and of the Science and Research Bureau of the War Department, the invention was taken up and brought to a high state of perfection.

The construction of the Weinberg tank is indicated in the diagram. Primarily it is an ordinary metal tank, having two connections and its filler cap. The suction connection is to provide a partial vacuum above the liquid, of sufficient strength to prevent its escape through any hole

that may be shot through the tank wall. As anyone knows who has seen how an inverted tumbler full of water behaves, the force that has to be added to the external atmospheric resistance to balance the gravitational pull on a fluid is a slight one. The necessary suction can be got in various ways, but probably most simply by the venturi shown, which operates by virtue of the stream of air created through the very flight of the plane. For a standing tank, of course, some mechanical means of suction would have to be employed. The fuel reaches the carburetor through the second opening by overcoming the vacuum created through the former—which may be accomplished by maintaining a greater suction, or by positive feed pumps.

To insure proper functioning at all times, the tank is enveloped in some elastic material analogous to the Zeppelin covering, which to a large extent plugs up whatever holes may be shot in the tank. Such substances are well known, possessing sufficient elasticity to return practically to their former state after being pierced, leaving a hole so small as almost to defy detection. The tank may literally be made a sieve by hostile fire and still refuse to leak.

The application of this principle to render the tank leak-proof makes it at the same time explosion-proof. To cause an explosion there must be a combustible mixture of air and fuel; but in the Weinberg tank no such mixture can be created anywhere. A bullet piercing the tank below the level of the liquid is at once surrounded by the liquid and smothered. No air is in this part of the tank, and none can get in; there is no hole for air to pour in through, no leak where air and gasoline meet. The proposition of smothering a flame with a blanket of highly combustible material is a startling one; but in the utter exclusion of oxygen it is a wholly sound one. And if on the other hand the bullet penetrates the upper portion of the tank, where there is no fuel, there is likewise here no air in sufficient quantity to give the basis for an explosion; for the venturi suction has taken care of that. So again the incendiary bullet is smothered, this time in a blanket of nothing at all.

Final tests of the Weinberg tank were made at Dayton. Two identical tanks, one made after the Weinberg plans and the other covered with elastic materials prepared by the War Department, were shot at side by side with armor-piercing and incendiary bullets. The second tank caught fire after the third shot; the Weinberg tank was penetrated by 15 piercer bullets followed by seven incendiaries, with neither leak nor explosion.

A bullet rarely goes completely through a fuel tank; ordinarily it is so checked in passage through the near wall and the fluid that it falls, spent, to the bottom of the tank. Through the Weinberg invention, which prevents it from igniting the gasoline in passage through the tank, or in repose therein, the tank that formerly possessed the greatest danger for the aviator becomes now his best protection. Moreover, a tank which eliminates danger of fire and leaks should be of value in peace as well as in war, and in many other places than on airplanes.—*Scientific American*, 7/12.

British Aeronautic Losses During the War.—From the English Air Ministry it is learned that the British aeronautic losses through war were as follows:

Dead	6,166
Wounded	7,245
Prisoners and missing	3,128
Interned	84
Total	16,623

Of these, 12,787 were officers and 3,936 privates; and this because the former were used especially in piloting machines.—*Rivista Marittima*, April, 1919.

MISCELLANEOUS

PEACE TERMS.—The peace terms for Austria were presented to the Austrian delegations at St. Germain-en-Laye on June 2. In communicating the terms, M. Clemenceau said a maximum period of 15 days would be allowed the delegates in which to present their written observations, and then a date for the final answer would be announced. The terms, which are incomplete, include the following parts: Preamble, League of Nations, frontiers of Austria, political clauses—Czecho-Slovak state, political clauses relating to certain European states, protection of minorities, general provisions, Austrian interests outside Europe, naval and air clauses, prisoners of war and graves, penalties, economic clauses, aerial navigation, ports, waterways and railways, labor and miscellaneous provisions.

The following clauses will be handed over at a later period: (1) Political clauses—Italy; (2) financial clauses; (3) reparation clauses; (4) military clauses; (5) clauses relating to the Serbo-Croat-Slovene state.

The following is a summary of the clauses dealing with the navy, aircraft, prisoners of war, graves and penalties:

Naval.—The naval terms provide that from the date of the coming into force of the Treaty all Austro-Hungarian warships, including submarines and all vessels of the Danube Flotilla, are declared to be finally surrendered to the principal Allied and Associated Powers. Auxiliary cruisers, etc., to the number of 21, are to be disarmed and treated as merchant ships. All warships (including submarines) now under construction in ports which belong or have belonged to Austria-Hungary are to be broken up. Articles and materials arising therefrom may not be used except for industrial purposes, and may not be sold to foreign countries. The construction or acquisition of any submarine, even for commercial purposes, is forbidden. All naval arms, ammunition, and other war material belonging to Austria-Hungary at the date of the armistice are to be surrendered to the Allies. The Austrian wireless station at Vienna is not to be used for naval, military, or political messages relating to Austria or her late Allies without the assent of the Allied and Associated governments during three months, but only for commercial purposes, under supervision. During the same period Austria is not to build any more high-power wireless stations.

Aircraft.—The air clauses provide that the armed forces of Austria must not include any military or naval air forces. The entire personnel of the air forces in Austria is to be demobilized within two months. The aircraft of the Allied and Associated Powers are to enjoy full liberty of passage and landing over and in Austrian territory until January 1, 1923, unless prior to that date Austria is admitted to the League of Nations or is permitted to adhere to the International Air Convention. The manufacture of aircraft and parts of aircraft is forbidden for six months. All military and naval aircraft (including dirigible and aeronautical material) are to be delivered to the Allied and Associated governments within three months.

General.—General articles provide for the modification of Austrian laws in conformity with the preceding clauses.

Austria agrees not to accredit or send any military, naval or air mission to any foreign country, nor to allow Austrian nationals to enlist in the army, navy or Air Service of any foreign Power.

Prisoners of War.—The repatriation of Austrian prisoners and interned civilians is to be carried out by a commission composed of representatives of the Allies and the Austrian Government, together with local sub-commissions. Austrian prisoners of war and interned civilians are to be returned without delay by the Austrian authorities at their own cost. Those under sentence for offences against discipline committed before May 1, 1919, are to be repatriated without regard to the completion of their

sentence, but this does not apply in the case of offences other than those against discipline. The Allies have the right to deal at their own discretion with Austrian nationals who do not desire to be repatriated, and all repatriation is conditional on the immediate release of any Allied subjects still in Austria. The Austrian Government is to accord facilities to Commissions of Inquiry in collecting information in regard to missing prisoners of war, and in imposing penalties on Austrian officials who have concealed Allied nationals. The Austrian Government is to restore all property belonging to Allied prisoners, and there is to be a reciprocal exchange of information as to dead prisoners and their graves.

Graves.—The Allies and the Austrian Government are to respect and maintain the graves of all soldiers and sailors buried in their territories and to recognize and assist any commissions appointed by the Allies in connection with them, agreeing also to give any practicable facilities for removal and reburial.

Penalties.—Military tribunals are to be set up by the Allies to try persons accused of acts of violation of the laws and customs of war, and the Austrian Government is to hand over all persons so accused. Similar tribunals are to be set up by any particular Allied Power against whose nationals criminal acts have been committed. The accused are to be entitled to name their own counsel, and the Austrian Government is to undertake to furnish all documents and information, the production of which may be necessary.—*Army and Navy Gazette*, 6/7.

WORLD'S TONNAGE LOSSES DURING WAR PERIOD.—According to an estimate made by *La France Maritime*, 4855 vessels aggregating 11,255,510 gross tons were lost through war's cause between August 1, 1914, and October 31, 1918. Of these, 3604 were steamers representing 10,542,925 tons and 1251 sailing vessels with a combined tonnage of 712,785 tons. Including losses suffered through ordinary marine casualties, the total tonnage destroyed during the period mentioned amounted to 14,344,082 gross tons. By years this is apportioned as follows:

1914	765,041
1915	1,984,387
1916	3,089,014
1917	5,065,849
1918	3,439,791

According to countries, these losses grouped themselves as follows:

Countries	Gross tons	No. of ships
England	6,194,237	1,961
Norway	1,213,866	794
France	920,355	586
Italy	782,284	448
America	408,303	151
Denmark	243,765	249
Holland	197,764	86
Germany	197,076	75
Sweden	163,521	137
Spain	150,021	70
Russia	139,937	118
Japan	109,436	26
Belgium	68,626	30
Portugal	55,075	41

—*Nautical Gazette*, 7/12.

DANISH-SWEDISH TUNNEL TO BE BUILT.—It is announced that the construction of the proposed tunnel between Denmark and Sweden is soon to be commenced. Its starting point is on the island of Amagar. When completed it will have a length of nearly 18 kilometers.—*Nautical Gazette*, 6/28.

MOVIE FILMS MAY DECIDE FATE OF U-BOAT COMMANDERS.—Nine thousand feet of motion-picture film may decide the fate of three German submarine commanders, if they are brought to trial before a British court-martial.

This remarkable piece of evidence shows vividly the sinking of 30 Allied ships by U-boats. It was photographed for propaganda purposes in the "Fatherland" by the crews of submarines, who thus unwittingly provided evidence against themselves.

The set of original films is in the hands of American intelligence officers. It will be turned over to the British Admiralty in the event the latter wishes it. The films were captured in Coblenz when the Americans entered that city in December. They were taken into a local movie theater and projected before officials of the Third Army. So perfectly was every detail of the sinkings shown that American officers said the pictures could not have been better, even if made by the Allies, for the purpose for which it is now proposed they be used.

Pictures of Commanders.—One of the films showed good photographs of the commanders, with the names and numbers of their U-boats. But the finest bit of "art" is believed to be the reproduction of the original of a report sent to Berlin by the skipper of the *U-33*. in which the names of ships sunk and the dates are clearly shown.

The series starts with the U-boats leaving their bases and threading their way through the mine fields, then are shown interior views depicting the excitement when the first Allied ship is sighted. Then the launching of the torpedo is shown. Following this there is a "close-up" of the ship heeling over and the crew scrambling into small boats.

Another graphic picture shows a U-boat officer ordering the captain of a sinking ship to turn over his log book. The angry captain stands in a boat alongside the half-submerged submarine, shaking his fist at the German officer, who laughs and orders him to come aboard, where he is made a prisoner. The remainder of the ship's personnel are left behind to shift for themselves.

Shows Shelling of Ships.—Other scenes depict the Germans shelling ships to hasten their destruction. The boilers of one ship blow up, tearing the craft to pieces.

Altogether the death throes of 30 ships are pictured. In one or two films U-boats are shown towing small boats with survivors aboard, with the caption: "Our men show humanity to the enemy."

These pictures were shown throughout Germany during the war to stimulate U-boat recruiting and "patriotism" generally.—*Baltimore Sun*, 7/11.

U. S. TROOPS TRANSPORTED OVERSEAS.—The War Department has just published a statistical summary of the war with Germany. It states that the number of soldiers sent to the other side was 2,086,000. The greatest number of men sent overseas in a single month was 306,000 and the largest number who have been returned home from Europe in a single month, at the time the report was compiled, was 333,000. The supplies shipped from the United States to France amounted to 7,500,000 tons in the 19 months that the American forces were in action.

Most of the troops sent overseas sailed from New York, half of them landing in France and the other half in England. Of every 100 Americans sent overseas, 49 went in British, 45 in American, 3 in Italian, 2 in French, and one in Russian ships, the Russian ships being under British control.

The ports from which our troops were shipped and those at which they were landed in Europe are shown in the following table:

Ports of embarkation	No. of men
New York	1,656,000
Norfolk	288,000
Boston	46,000
Philadelphia	35,000
Montreal	34,000
Quebec	11,000
Portland	6,000
Halifax	5,000
Baltimore	4,000
St. Johns	1,000
Total	2,086,000

Ports of arrival IN GREAT BRITAIN	No. of men
Liverpool	844,000
London	62,000
Southampton	57,000
Glasgow	45,000
Bristol Ports	11,000
Manchester	4,000
Falmouth	1,000
Plymouth	1,000
Total	1,025,000

IN FRANCE	
Brest	791,000
St. Nazaire	198,000
Bordeaux	50,000
Le Havre	13,000
La Pallice	4,000
Marseille	1,000
Total	1,057,000

American cargo ships averaged one round trip every 70 days, and the troopships one round trip every 35 days. The cargo fleet was almost exclusively American, and reached the size of 2,600,000 deadweight tons. The greatest of the troop carriers was the *Leviathan*, formerly the Hamburg-American liner *Vaterland*, which landed 12,000 men, or the equivalent of a German division, in France every month while the troop movements were approaching their maximum. The fastest of the troopships were the Pacific liners *Great Northern* and *Northern Pacific*, which have made complete turn-arounds, taken on new troops and started back to Europe again in 19 days. In France American engineers built 83 new ship berths.—*Nautical Gazette*, 7/5.

RELATIVE STANDING OF THE WORLD'S NAVIES, 1919.—The following table, compiled by the United States Navy Department, Washington, has been presented to Congress:

	Great Britain		United States		Japan		France		Italy	
	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
Battleships	55	1,103,900	39	711,596	13	273,427	18	338,976	11	177,350
Battle cruisers	9	205,500	...	...	7	152,950	...	...	...	...
Cruisers	24	300,150	8	111,900	12	113,242	18	185,957	5	45,696
Light cruisers	73	296,045	13	55,160	9	34,845	1	2,421	6	19,538
Coast-defence vessels	32	8,590	4	12,900	...	...	...	...	1	1,630
Torpedo-boat destroyers	369	350,020	105	109,060	65	37,177	65	37,505	47	34,950
Torpedo-boats	34	9,576	...	...	24	2,984	79	7,312	96	15,148
Submarines	140	(1)	84	32,176	16	3,414	58	22,026	78	(?)21,645
Total	736	2,273,781	253	1,032,792	146	618,039	239	594,197	244	(?)315,927
BUILDING AND PROJECTED, 1919										
Battleships	...	...	13	485,600	4[3]	128,000	5 4	124,150 83,600[3]	...	...
Battle cruisers	4[2]	164,800	6[4]	211,416	...	...	...	...	...	...
Cruisers	...	...	10	63,900	...	...	...	...	...	...
Light cruisers	21[2]	125,235	...	...	7	24,500	...	...	...	...
Torpedo-boat destroyers	115[2]	141,855	237	286,779	9 14	11,700 (4)	1	890	16	19,435
Torpedo-boats	...	...	...	...	...	...	...	...	4	640
Submarines	79[2]	66,871	83[5]	68,694	4 6	3,000 (1)	8	(1)	11	3,399
Total	219[2]	498,761	349	1,116,389	24	167,200	14	125,040	31	23,474

[1] Unknown.

[2] The Financial Secretary to the Admiralty stated in the house of Commons on May 9 that four ships of the *Hood* class—battle cruisers—had been laid down, and of these the *Hood* was being carried to completion. The construction of the other three ships, which were laid down in the autumn of 1916, was stopped in March, 1917, when the vessels were in very early stages of building, at a saving of expenditure of from 18 to 20 millions. It is also known, that the construction of most of the light cruisers, destroyers, and submarines has also been abandoned.

[3] One laid down. [4] Not laid down. [5] Including nine not laid down.

NOTE.—Battleships, battle cruisers, cruisers, light cruisers, and coast-defence vessels over 20 years of age, and torpedo-boat destroyers, torpedo-boats and submarines over 15 years of age, are not included.

—*The Fortnightly Review*, June, 1919.

CURRENT NAVAL AND PROFESSIONAL PAPERS

UNITED STATES

The League of Nations. W. G. McAdoo. *Outlook*, July 2, 1919.

The Future of Permanent Fortifications. C. Beard. *Prof. Memoirs, Corps of Engrs.*, U. S. Army & Eng. Dept., vol. 11, no. 55, Jan.-Feb., 1919, pp. 47-64.

The Berlin-Bagdad Line. John H. Finley. *Scribner's Magazine.*

Railway Artillery. E. D. Campbell. *Jl. Engrs. Club of St. Louis*, vol. 4, no. 2, Mar.-Apr., 1919, pp. 142-160, 9 figs. Historical sketch and forecast of future types.

Aeroplane Construction. F. G. Coburn. *Jl. Engrs. Club*, Philadelphia, vol. 36-4, no. 173, Apr., 1919, pp. 121-126, 6 figs. Brief account of construction and development of naval aircraft factory at Philadelphia Navy Yard.

Some Experiences with Electric Welding in Warships. W. H. Gard. *Shipbuilding & Shipping Rec.*, vol. 13, no. 16, Apr. 17, 1919, pp. 485-486.

Repairing cast-steel stern post of battleship and similar work carried out during the war. Paper read before Institution Naval Architects.

On the Determination of the Electrical and Acoustic Characteristics of Telephone Receivers. Louis V. King. *Jl. Franklin Inst.*, vol. 187, no. 5, May, 1919, pp. 611-625, 5 figs. Theoretical aspect presented from viewpoint of possible improvements.

Research Work on Malleable Iron. Enrique Touceda. *Mechanical Engineering*, July, 1919.

GREAT BRITAIN

Peace and a Naval Holiday. Archibald Hurd. *The Fortnightly Review*, June, 1919.

The Ocean Convoys. A. R. Herbert. *Land and Water*, May 1, 1919.

ITALY

The Italian Navy in the Adriatic During the War. Captain Charles Di Villarey, C. B., M. V. O., Royal Navy. *The Journal of the Royal United Service Institution*, May, 1919.

Fiume. Hilaire Belloc. *Land and Water*, May 29, 1919.

DIPLOMATIC NOTES

FROM JUNE 18 TO JULY 18

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

GERMANY RATIFIES PEACE TREATY

GERMAN ASSEMBLY VOTES TO SIGN TREATY.—On Sunday, June 22, the German National Assembly voted 237 to 138 to sign the Peace Treaty, but without accepting the obligations contained in Articles 227-230 relating to the trial of the ex-Kaiser and extradition of other Germans accused of crimes, and Article 231, fixing upon Germany responsibility for the war. The Centrists and Democrats held out for this modification of the terms.

On the same date the Bauer Cabinet communicated with the Entente Powers requesting a delay of 48 hours before submitting the final decision of Germany, but received a brief negative reply with the further information that the Allied terms must be accepted without reservations. Accordingly on June 23 the Assembly voted for unconditional acceptance, and the decision was transmitted as follows by Dr. Haniel von Haimhausen, the German representative at Paris:

> The Minister of Foreign Affairs has instructed me to communicate to your Excellency the following:
>
> "It appears to the government of the German Republic, in consternation at the last communication of the Allied and associated governments, that these governments have decided to wrest from Germany by force acceptance of the peace conditions, even those, which, without presenting any material significance, aim at divesting the German people of their honor.
>
> "No act of violence can touch the honor of the German people. The German people, after frightful suffering in these last years, have no means of defending themselves by external action.
>
> "Yielding to superior force, and without renouncing in the meantime its own view of the unheard of injustice of the peace conditions, the government of the German Republic declares that it is ready to accept and sign the peace conditions imposed."
>
> Please accept, Mr. President, assurances of my high consideration.
>
> (Signed) VON HANIEL.

NEW GERMAN CABINET FOR TREATY ACCEPTANCE.—Rather than face the responsibility for signing the Peace Treaty, the Scheidemann Cabinet resigned, seven voting for and seven against acceptance. After a week of effort a new Ministry was finally organized on June 21 with Gustav Adolf Bauer, a Conservative Socialist and labor leader, as Premier; Dr. Hermann Müller, Majority Socialist, Minister of Foreign Affairs; Mathias Erzberger, Minister of Finance and Vice-Chancellor; and Dr. Edouard Daniel, Minis-

try of the Interior. Reports from Germany referred to the new Cabinet as transitional in character and mediocre in personnel, dominated by Erzberger.

THE CEREMONY AT VERSAILLES.—The German delegates selected to sign the treaty, Drs. Hermann Müller and Johannes Bell, arrived at Versailles on June 27. The ceremony of signing occurred at 3 p. m. on the following day in the Hall of Mirrors at Versailles before a crowded gathering of officials, diplomats, and press representatives, with an immense throng in the grounds outside the palace. After very brief remarks by President Clemenceau, the German delegates signed the Treaty and the Rhine Agreement at 3.12, and were followed by the American, British, French, Japanese, Italian and other delegates in order.

General Smuts signed after filing a statement criticizing the severity of certain requirements in the Treaty.

CHINA REFUSES TO SIGN.—Following repeated efforts to secure permission to sign the treaty with reservation regarding the Shantung settlement, the Chinese delegates at Paris refrained from attaching their signatures, and at the same time issued a statement explaining their position:

> The statement says that the action of the conference on Shantung evoked a nation-wide protest in China, which makes it impossible for the Chinese Government to accept the objectionable clause in the treaty.
>
> The delegation's proposal was that it should write in the treaty above its signature, "Subject to reservation made at the plenary session of May 6, relative to the question of Shantung in Articles 156, 157, and 188." The statement says that the Peace Conference, through official channels, denied the privilege of any action on the part of China which would make it possible to reopen the Shantung question.
>
> "After failing in all earnest attempts at conciliation," says the statement, "and after seeing every honorable compromise rejected, the Chinese delegation had no course open save to adhere to the path of duty to their country."

China, it is said, is willing to accept the Shantung settlement on two conditions: (1) that Japan set a definite date for the restoration of Kiao Chau, any time within a year being regarded as a reasonable period; and (2) that Japan withdraw police from the Shantung railways. The Chinese delegates remained in Paris, expecting to participate in the Austrian settlement and in the organization of the League of Nations.

TREATY RATIFIED BY GERMANY.—The Peace Treaty was ratified by the German Assembly at Weimar on June 9 and signed that evening by President Ebert. Before the final ratification, a resolution was defeated proposing a judicial tribunal to pass upon the legality of the trial of the ex-Kaiser and upon the question of responsibility for the war. The official notice of ratification was accompanied by a request that the blockade be raised and prisoners of war liberated as soon as possible.

GERMAN BLOCKADE RAISED.—The Superior Blockade Council on June 26 announced that it had been decided to resume trade with Germany immedi-

ately upon ratification of the Treaty by the German Assembly, without awaiting final ratification by the Entente Powers.

Washington, July 14.—Formal announcement was made to-night by the State Department that free communication and the resumption of trade relations with Germany had been authorized, effective to-day, and that hereafter only a few restrictions covering principally the importation of sugar, wheat, dyes, potash, drugs, and chemicals would remain in force. The export conservation list and bunker regulations are wiped out, and wheat is the only export commodity subject to control, its distribution for export remaining under the Grain Corporation.

The orders issued to-day in effect place the United States on a basis of open trading with all nationalities of the world, under the "blanket license" system, so far as the great majority of commodities are concerned, with the exceptions of Hungary and that part of Russia under the control of the Bolsheviki.—*N. Y. Times*, 15/7.

TRIAL OF EX-KAISER IN LONDON.—Premier Lloyd George on July 4 announced before the House of Commons that it had been decided to hold the trial of the ex-Kaiser in London before a tribunal composed of judicial representatives of the chief Entente Powers, including the United States, with a British judge presiding.

Later reports indicated that Washington had been considered as the scene of the trial, but that President Wilson had preferred a European capital. London was selected in the belief that a trial in England under Anglo-Saxon legal procedure would not be open to accusation of unfairness.

At the time of going to press uncertainty still existed as to whether the trial would actually take place and as to the attitude of the Dutch Government on the question of extradition. A Copenhagen despatch of July 11 reported that informal negotiations were already in progress with Holland and that the Dutch Government was ready to deliver the ex-Kaiser to the Entente Powers.

PARIS COUNCIL REORGANIZED.—Paris, June 30 (Associated Press).—The new Council of Four, consisting of Stephen Pichon, the French Foreign Minister; Robert Lansing, the American Secretary of State; Arthur J. Balfour, the British Foreign Secretary, and Tomasso Tittoni, the Italian Foreign Minister, will meet to-morrow afternoon to outline the method of procedure of the Peace Conference, which is likly to undergo many changes.

M. Pichon will be chairman of the council. It is probable that a body similar to the old Council of Ten will be constituted, but the Council of Four will continue the work of direction.

The missing clauses in the Austrian treaty will probably be delivered to the Austrian delegation before the end of the week, but it seems unlikely that the treaty can be signed before July 31 at the earliest.

UNITED STATES

FRANCO-AMERICAN AGREEMENT.—The text of the duplicate agreements signed by Great Britain and the United States with France to insure support to France in the event of Germany's failure to observe the peace terms regarding the western frontier, was published on July 2. The agreement

with the United States first states the reasons for the understanding and cites Articles XLII-XLIV of the Peace Treaty. It concludes as follows:

In case these stipulations should not assure immediately to France appropriate security and protection, the United States of America shall be bound to come immediately to her aid in case of any unprovoked act of aggression directed against her by Germany.

Article II.—The present treaty, couched in terms analogous to those of a treaty concluded on the same date and to the same end between Great Britain and the French Republic, a copy of which is hereto annexed, will not enter into force until the moment when the latter is ratified.

Article III.—The present treaty must be submitted to the Council of the Society of Nations and must be recognized by the council, deciding if occasion arise by majority, as an engagement in conformity with the covenant of the society. It will remain in force until, upon demand of one of the parties to the treaty, the council deciding if occasion arise by a majority, finds that the society itself assures sufficient protection.

Article IV.—The present treaty shall before ratification be submitted to the chambers of the French Parliament for approval, and it shall be submitted to the Senate of the United States of America at the same time as the treaty of Versailles shall be submitted for assent to ratification. Ratifications shall be exchanged at the time of deposit in Paris of the ratifications of the treaty of Versailles, or as soon afterwards as possible.

The agreement is signed by M. Clemenceau, M. Pichon, Mr. Wilson, and Mr. Lansing. It is significant that the third article of the Agreement makes it subject to the approval of the Council of the League of Nations.

PRESIDENT DEFENDS TREATY.—President Wilson left Paris on June 28 and arrived in New York on July 8. After speaking in New York he at once went to Washington, and on July 10 delivered the Peace Treaty to the Senate assembled in open session. His speech at this time was an appeal for unqualified ratification of the Treaty and acceptance of the international responsibilities involved in the plan for a League of Nations. Referring to the league, the President said:

Convenient, indeed indispensable, as statesmen found the newly planned League of Nations to be for the execution of present plans of peace and reparation, they saw it in a new aspect before their work was finished. They saw it as the main object of the peace, as the only thing that could complete it or make it worth while. They saw it as the hope of the world, and that hope they did not dare to disappoint.

Shall we or any other free people hesitate to accept this great duty? Dare we reject it and break the heart of the world?

He closed as follows:

America may be said to have just reached her majority as a world power. It was almost exactly twenty-one years ago that the results of the war with Spain put us unexpectedly in possession of rich islands on the other side of the world and brought us into association with other governments in the control of the West Indies.

It was regarded as a sinister and ominous thing by the statesmen of more than one European Chancellery that we should have extended our power beyond the confines of our continental dominions. They were accustomed to think of new neighbors as a new menace, of rivals as watchful enemies.

There were persons amongst us at home who looked with deep disapproval and avowed anxiety on such extensions of our national authority over distant islands and over peoples whom they feared we might exploit, not serve and assist. But we have not exploited them. We have been their friends and have sought to serve them. And our dominion has been a menace to no other nation. We redeemed our honor to the utmost in our dealings with Cuba. She is weak but absolutely free, and it is her trust in us that makes her free.

Can We Refuse Moral Leadership?—Weak peoples everywhere stand ready to give us any authority among them that will assure them a like friendly oversight and direction. They know that there is no ground for fear in receiving us as their mentors and guides.

Our isolation was ended twenty years ago, and now fear of us is ended also, our counsel and association sought after and desired. There can be no question of our ceasing to be a world power. The only question is whether we can refuse the moral leadership that is offered us, whether we shall accept or reject the confidence of the world.

The war and the conference of peace, now sitting in Paris, seem to me to have answered that question. Our participation in the war established our position among the nations, and nothing but our own mistaken action can alter it. It was not an accident or a matter of sudden choice that we are no longer isolated and devoted to a policy which has only our own interest and advantage for its object. It was our duty to go in, if we were, indeed, the champions of liberty and of right.

We answered to the call of duty in a way so spirited, so utterly without thought of what we spent of blood or treasure, so effective, so worthy of the admiration of true men everywhere, so wrought out of the stuff of all that was heroic that the whole world saw at last, in the flesh, in noble action, a great ideal asserted and vindicated by a nation they had deemed material and now found to be compact of the spiritual forces that must free men of every nation from every unworthy bondage. It is thus that a new rôle and a new responsibility have come to this great nation that we honor and which we would all wish to lift to yet higher levels of service and achievement.

The stage is set, the destiny disclosed. It has come about by no plan of our conceiving, but by the hand of God, who led us into this way. We cannot turn back. We can only go forward, with lifted eyes and freshened spirit, to follow the vision. It was of this that we dreamed at our birth. America shall in truth show the way. The light streams upon the path ahead, and nowhere else.

THE TREATY AND THE MONROE DOCTRINE.—In conference with Senators on July 10 the President spoke as follows regarding the bearing of the Peace Treaty upon the Monroe Doctrine:

Touching on the Monroe Doctrine the President said that he brought the matter up in Paris, and as a result there was an acknowledgment of the doctrine which had never before had any standing in international law, being only a declaration of the President of the United States. He held that the action in Paris was a guarantee of recognition of the doctrine, and that furthermore the League would, by its terms, prevent aggression by European powers against any Central or South American powers. The President appeared perfectly certain on this point, and the Senators present understood him to believe that recognition by the League of the doctrine constituted a sort of second line of defence.

It came out during the conversation that the President expected the Japanese to fix a definite time when they would retire from the Shantung Peninsula granted them in succession to the German rights. It is understood here that the President used strong efforts, while in Paris, to induce the Japanese to fix definitely the time of their retirement from Shantung.

POLAND AND RUSSIA

POLAND AN INDEPENDENT STATE.—The text of a treaty signed by Poland and the Entente Powers appeared in the press of July 2. The treaty establishes Poland as an independent European state, under the guarantee of the League of Nations, and provides religious toleration, protection to Jewish citizens, and safeguards of the rights of minority peoples.

Paris, June 30.—In transmitting to the Polish Government the treaty which has since been signed by Poland with the Entente Powers and the United States, Premier Clemenceau, as President of the Peace Conference, addressed a letter to Premier Paderewski setting forth the reasons why the provisions of the document were considered necessary. Under the treaty Poland agreed to protect minorities against discrimination, to assume payment of such a share of the Russian debt as should be assigned to her by the Interallied Commission, and to support important international postal, railway, telegraphic, and other conventions incidental to the establishment of a national standing.

AMERICAN MISSION TO OMSK.—Washington, July 7.—Roland S. Morris, the American Ambassador to Japan, left Tokio to-day for Siberia, on an extended trip which will take him as far as Omsk, the seat of the Provisional Government headed by Admiral Kolchak, to report to President Wilson on the situation. It is understood that the according of full recognition of the Omsk Government in place of the present quasi-recognition that has already been granted by the Allied and associated governments will follow the report of Ambassador Morris, provided this is favorable.

Ambassador Morris will be met at Vladivostok by General William S. Graves, commander of the American forces in Siberia, who will accompany him to Omsk and will also make a report on conditions there and in the rest of Siberia.—*N. Y. Times*, 8/7.

INQUIRY ABOUT ALLEGED SECRET TREATY.—On July 16 the United States Senate adopted a resolution introduced by Senator Lodge requesting the President for any available information regarding a secret treaty said to have been negotiated between Japan and Germany in October, 1918, embodying a plan for Russian rehabilitation and promising Japan's indirect protection of German interests in the Versailles negotiations. In speaking of the alleged treaty, Senator Lodge stated that he had no evidence of its existence other than a press report from Budapest on June 20. This report, based on a wireless from Moscow, gave the terms of the agreement as follows:

1. Both parties undertake to lend a helping hand to the third treaty party (Russia) as soon as compatible with the world's political situation for the restoration of her internal order, international prestige, and power.
2. Japan undertakes the granting to Germany of advantages resulting from the most favored nation reciprocity clauses of the existing Russo-Japanese treaty.
3. Japan undertakes to permit Germany to participate, in accordance with concessions embodied in this special treaty, in Japan's preferential treaty rights in China, the parties undertaking to exclude foreign powers (United States and Great Britain) from securing further concessions there.
4. Japan undertakes the safeguarding, indirectly, of Germany's interests in the forthcoming Peace Conference, striving for minimum territorial and material advantages to Germany.

REVIEW OF BOOKS
ON
SUBJECTS OF PROFESSIONAL INTEREST

"The Whys and Wherefores of Navigation." By Gershom Bradford 2d, 159 pages, illustrated. (New York: D. Van Nostrand Company.)

This book, as the author states in the preface, is intended to be supplementary to the American Practical Navigator, Bowditch.

Nautical Astronomy and the celestial and the terrestrial elements used in navigation are explained clearly.

It is, of course, always possible to find some inaccuracies or real errors in a book of this class, but there are none in this book that are of any considerable proportions.

The chapter devoted to "Time," which, as it should be, is the longest chapter in the book, is a very good explanation of that bugbear of the beginners.

In the chapter on "Latitude," in explaining the ex-meridian sight, the author calls attention to the fact that the meridian altitude (obtained by adding the reduction) is the meridian altitude for the position of the ship *at the time of the sight* and he states that, with a 20-knot ship, the discrepancy in latitude, due to neglecting the run between sight and noon, can amount to three miles in the case of a 9-minute ex-meridian sight. Mention should have been made of the fact that the *maximum altitude observed when watching for the sun to dip* is not the correct meridian altitude when a ship is steering a northerly or southerly course. In the case of a 20-knot ship the discrepancy will amount to more than three miles. These two sources of error go hand in hand and as both are frequently neglected at sea, it would seem that one should not be mentioned without the other.

In the chapter on the moon the usual statement is made in regard to the unpopularity, among navigators, of the moon for sights. This prejudice against moon sights was well founded in the past, but now that Table 49, Bowditch, eliminates so much of the chance of error in altitude correction and the chronometer error can be accurately determined so frequently, there is no longer a good excuse for treating the moon with contempt. An additional paragraph mentioning Table 49, Bowditch, and the consequent increase of the value of the moon for navigational purposes would strengthen this chapter considerably.

For rule-o'-thumb navigators who really desire to know the "Whys and Wherefores" this book is very good. Its subject matter and its explanations are so clearly expressed that no great knowledge is necessary to understand it.

T. W.

"Simple Rules and Problems in Navigation." By Charles H. Engle. Revised by Bradley Jones. 305 pages, 1 plate. (Published by E. P. Dutton and Company, New York City.)

The purpose of this book, as expressed in the preface, is very well served. "The purpose of this book is to lay before the student all the rules and problems of navigation used in every day work at sea, with short definitions of the theory of navigation, and other useful information that the young officer should know."

The book is intended for the Merchant Marine and especially for those students who have but little mathematical or technical knowledge.

Most of the theory has been eliminated and hard and fast rules given for the various steps in solving problems.

In giving sample problems quite a number of each class are given with the solutions clearly worked out. In fact, these problems with their well explained solutions form one of the best features seen in any recent book on navigation.

A typical example of the complete and clear rules for the various problems and one that fully explains the methods of this book is as follows:

Latitude by Meridian Altitude of Star:

"The declination of a star having a very small annual change, it is only necessary to take out the minutes for the month, and the number of degrees on the side opposite the star used.

Declination is found on page 95, Nautical Almanac.

There is no Semi-diameter or Parallax for a star, so the meridian altitude is corrected as follows:

Index Error as per sign, if any.

Dip (Table 14) subtract.

Refraction (Table 20A) subtract.

Answer will be true altitude.

Subtract true altitude from 90°. Answer will be Zenith Distance, to be named opposite name to star's bearing.

Under Zenith Distance put down declination and apply as follows:

Same names, add.

Different names, subtract less from greater.

Answer will be latitude.

Name the latitude as follows:

If added, will be named the same as the two of them.

If subtracted, will be named the same as greater of two."

Following this set of rules are no less than twelve problems clearly worked out.

Altogether this is a very good book for the use of the merchant marine officer.

T. W.

"Comrades of the Mist and Other Rhymes of the Grand Fleet." By Lieut. Commander E. E. Wilson, U. S. N. $1.00 net. (New York: George Sully and Company.)

The title of this little book of verse is explained in the dedication, "to our 'Comrades of the Mist,' the officers and men of the British grand fleet," and the volume bears a warm tribute to the spirit of team-play between the British and American navies in the war. In particular it celebrates the entente cordiale that existed between the American battleship division under Rear Admiral Rodman and the other squadrons of the grand fleet.

Many of these verses appeared first in the publication of the *Arkansas*, the *Arklight*. Naturally, as the modest title, "Rhymes," suggests, these verses are not to be judged as poetry either in form or content. They are pleasant, jingly, little echoes of the life of the fleet during the war, snatches of the fun, the work, and the spirit of our officers and men. Those who knew those long months of waiting at Scapa Flow or Rosyth should find in this little book a welcome souvenir.

H. O. S.

"The Freedom of the Seas." By Louise Fargo Brown. 262 pages. $2.00 net. (New York: E. P. Dutton and Co., 1919.)

This is a well informed popular account of the historical development of the law of nations relating to sea commerce in war and peace. The author announces that she will publish later a more fully documented and more extended study of the same subject in the period following 1713, and that another student has in preparation a treatment of the earlier period. These will fill a real need, for aside from heavy works on international law and histories of commerce, the only readily available book in this field is Professor T. W. Fuller's *Sovereignty of the Sea*, which however deals chiefly with national claims to fishing and other rights in adjacent waters.

In early days, when the Pope made his extraordinary division of the world's waters between Portugal and Spain, and when Venice, England, Denmark, and the Hanseatic League each claimed actual dominion over vast areas of contiguous sea, the phrase "Freedom of the seas" had an important significance in both war and peace. In recent times, however, it has had little or no peace-time meaning, save as it has been confused with free trade, or the opening of a nation's ports and colonies to foreigners. Its real significance is as a name for the question to what extent a belligerent may interfere with commerce between enemy and neutrals in time of war.

In the recent war it will be generally granted that control of enemy commerce by sea power was exercised with fewer restrictions and with more far-reaching results than ever before. The author is very glad that this was so, yet she seems to regret it as a precedent in international law, holding (like many other writers) that real progress would lie in the direction of making all commerce, save trade in actual munitions of war, immune. This view is mistaken. Little can be gained by trying to limit the scope of war so as to make it a sort of medieval contest between small regular forces. The whole trend of modern war is the other way.

Nations must fight—with due regard for neutrals and humanity—but with every resource at their command.

True progress lies not in doing away with this weapon of sea power, but in making it the weapon of a combination of nations against any offender—in other words, a means of preventing war. This was recognized by President Wilson when he explained his sudden dropping of "freedom of the seas" by saying it had no significance if a league of nations were established. On the other hand, if a league of nations should not come into existence, we should fight very shy of "freedom of the seas."

A. W.

More members, both regular and associate, are much desired. Any increase in membership invariably means larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

S. A. Taffinder,
Secretary-Treasurer.

Attention is invited to extracts from the constitution on the opposite page as to the requirements in making applications for life, regular and associate membership. Members and associate members are liable for the payment of the annual dues until the date of the receipt of their resignation in writing. Annual dues $2.50.

....

....191

To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a $\left\{\begin{matrix}\textit{regular}\\ \textit{associate}\end{matrix}\right\}$ *member of the U. S. Naval Institute from this date.*

Very truly yours,

....

....

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the United States Naval Institute Proceedings, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the Proceedings, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The Proceedings are published monthly; subscription for non-members, $3.00; enlisted men, U. S. Navy, $2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

S. A. TAFFINDER,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

1898

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut. Commander Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903

Gunnery in Our Navy. The Causes of Its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure Its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905

American Naval Policy. Prize, Essay 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear Admiral Stephen B. Luce, U. S. N.

1906

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut. Commander A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906 By Pay Inspector J. A. Mudd. U. S. N.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A Few Thoughts on Our Next Step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut. Commander Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENCE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut. Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotton, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut. Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut. Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut. Commander Dudley W. Knox, U. S. N.

1914

The Great Lesson from Nelson for To-day. Prize Essay, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

NAVAL POLICY AS IT RELATES TO THE SHORE ESTABLISHMENT AND THE MAINTENANCE OF THE FLEET. Honorable Mention, 1914. By Captain John Hood, U. S. N.

OLD PRINCIPLES AND MODERN APPLICATIONS. Honorable Mention, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

MILITARY PREPAREDNESS. Honorable Mention, 1914. By Naval Constructor Richard D. Gatewood, U. S. N.

1915

The Rôle of Doctrine in Naval Warfare. Prize Essay, 1915. By Lieut. Commander Dudley W. Knox, U. S. N.

AN AIR FLEET: OUR PRESSING NAVAL WANT. First Honorable Mention, 1915. By Lieut. Commander Thomas Drayton Parker, U. S. N.

TACTICS. Second Honorable Mention, 1915. By Ensign H. H. Frost, U. S. N.

DEFENCE AGAINST SURPRISE TORPEDO ATTACK. Third Honorable Mention, 1915. By Ensign R. T. Merrill, 2d, U. S. N.

1916

The Moral Factor in War. Prize Essay, 1916. By Lieutenant (J. G.) H. H. Frost, U. S. N.

NAVAL PERSONNEL. First Honorable Mention, 1916. By Lieut. Commander J. K. Taussig, U. S. N.

EDUCATION AT THE U. S. NAVAL ACADEMY. Second Honorable Mention, 1916. By Lieutenant Ridgely Hunt, U. S. N.

SOME UNDERLYING PRINCIPLES OF MORALE. Third Honorable Mention, 1916. By Commander Dudley W. Knox, U. S. N.

LARGE *vs.* A GREATER NUMBER OF SMALLER BATTLESHIPS. Lippincott Prize Essay. By Lieut. Commander Thomas Lee Johnson, U. S. N.

1917

Commerce Destroying in War. Prize Essay, 1917. By Commander Lyman A. Cotten, U. S. Navy.

THE PEOPLE'S RÔLE IN WAR. First Honorable Mention, 1917. By Lieutenant H. H. Frost, U. S. Navy.

THE NATION'S GREATEST NEED. Second Honorable Mention, 1917. By Colonel Dion Williams, U. S. Marine Corps.

1918

Letters on Naval Tactics. Prize Essay, 1918. By Lieutenant H. H. Frost, U. S. N.

THE PREPAREDNESS OF THE FUTURE. First Honorable mention, 1918. By Commander H. O. Rittenhouse, U. S. N. Retired.

NAVAL STRATEGY. Second Honorable Mention, 1918. By Rear Admiral Bradley A. Fiske, U. S. N.

1919

MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.

SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

45 SEPTEMBER 1919 No. 199

United States Naval Institute Proceedings

The writers only are responsible for the contents of their respective articles

CONTENTS

Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 9 September, 1919 Whole No. 199

United States Naval Institute

Proceedings

PUBLISHED MONTHLY
EDITED BY S. A. TAFFINDER

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

CONTENTS

OFFICERS OF THE INSTITUTE

President

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

Vice-President

REAR ADMIRAL A. H. SCALES, U. S. NAVY

Secretary and Treasurer

COMMANDER S. A. TAFFINDER, U. S. NAVY

Board of Control

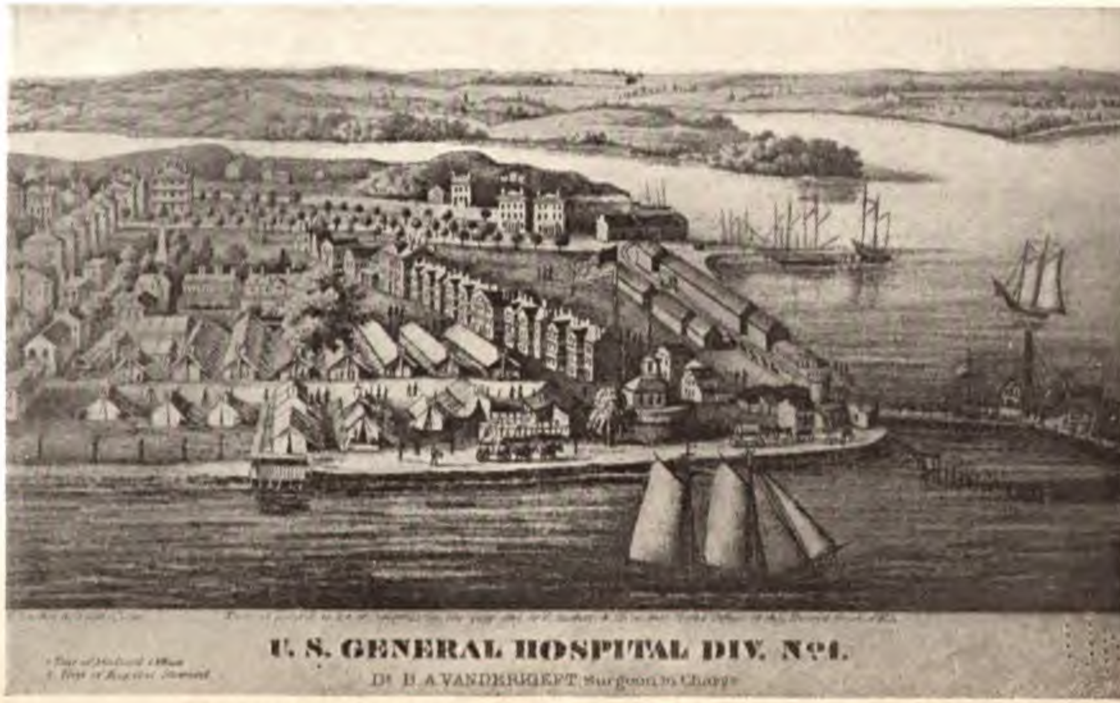
CAPTAIN W. T. CLUVERIUS, U. S. NAVY
CAPTAIN T. L. JOHNSON, U. S. NAVY
CAPTAIN E. J. KING, U. S. NAVY
CAPTAIN W. G. DU BOSE, CONSTRUCTION CORPS, U. S. NAVY
COMMANDER S. A. TAFFINDER, U. S. NAVY (*ex officio*)

PAST PRESIDENTS

OF THE

U. S. NAVAL INSTITUTE

ADMIRAL DAVID D. PORTER, U. S. NAVY, 1873
REAR ADMIRAL JOHN L. WORDEN, U. S. NAVY, 1874
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1875–JAN. 1878
COMMODORE FOXHALL A. PARKER, U. S. NAVY, JAN. 1878–JAN. 1879
REAR ADMIRAL JOHN RODGERS, U. S. NAVY, JAN. 1879–JAN. 1882
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1882–JAN. 1883
REAR ADMIRAL THORNTON A. JENKINS, U. S. NAVY, JAN. 1883–OCT. 1885
REAR ADMIRAL EDWARD SIMPSON, U. S. NAVY, OCT. 1885–OCT. 1887
REAR ADMIRAL STEPHEN B. LUCE, U. S. NAVY, OCT. 1887–OCT. 1898
REAR ADMIRAL WM. T. SAMPSON, U. S. NAVY, OCT. 1898–OCT. 1902
REAR ADMIRAL H. C. TAYLOR, U. S. NAVY, OCT. 1902–OCT. 1904
REAR ADMIRAL C. F. GOODRICH, U. S. NAVY, OCT. 1904–OCT. 1909
REAR ADMIRAL RICHARD WAINWRIGHT, U. S. NAVY, OCT. 1909–OCT. 1911



THE NAVAL ACADEMY TRANSFORMED INTO AN ARMY HOSPITAL DURING THE CIVIL WAR.

FROM AN OLD PRINT.

UNITED STATES NAVAL INSTITUTE
PROCEEDINGS

Vol. 45, No. 9 SEPTEMBER, 1919 Whole No. 199

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE UNITED STATES NAVAL WAR COLLEGE[1]

By Rear Admiral William S. Sims, U. S. Navy

Let us at the reopening of the college course begin by making sure that we have a clear understanding of why we are here, and particularly a clear understanding of the nature of the Naval War College and its functions.

It is not a college at all in the ordinary sense of the term. It belongs to no religious denomination. It has no fixed policy. Neither its head nor its staff is permanent. They are fleet officers and are continually being replaced by other officers from the fleet. The college is, in effect, part of the fleet, and it exists solely for the fleet.

The students bring to the college their practical fleet knowledge and experience. They are asked to consider this practical knowledge and experience in connection with the principles of warfare. These principles of warfare are nothing but deductions from the accumulated experience of those who have gone before us, including of course the acknowledged masters of war.

The results of this combination of the experience of the present with that of the past will constitute the principles and methods in current use at the college; and which you fleet officers will help further to develop and to apply.

[1] Address delivered at the opening course for class of June, 1919.

When you finish your course you will carry these principles back to the fleet, and will, I trust, be guided by them.

Some of you will doubtless be assigned to the staff and will pass these principles on to newcomers, who, in their turn, will contribute their fresh fleet experience. And in this way the process of development will be carried on in actual continuous cooperation with the fleet and with the service.

You will thus recognize that this is not really a college. Perhaps it would have been better if it had never been so designated, for in reality this assemblage is nothing but a board of practical fleet officers brought together here to discuss and decide the extremely important question of how we would best conduct naval war under the various conditions that may arise.

You should think of this board as belonging to the fleet—as being what you might call a fleet board on strategy and tactics, frequently making reports to the fleet and the service upon these vital subjects.

You should never lose sight of the fact that we are all practical fleet officers; that we shall go back to the fleet and be replaced by others from the fleet; that our work is wholly practical, because we base our conclusions upon our own experience and upon that of those who have gone before us; and that therefore there can be nothing theoretical about the principles of fighting that we decide to be the correct ones, or about the methods we devise for carrying them into effect.

Some officers complain that they do not understand the terms, the strange words, used by the college. I do not understand any of the strange words used by golfers, because I have never played the game, but I understand that some such words are necessary. They are equally necessary for the game of war. Every art must necessarily have its own rules, principles and methods, and these must have names if we are to talk about them—and we cannot practice an art or play a game without talking about it.

The principles of the war game constitute the backbone of our profession. All other kinds of nautical knowledge and experience, for example, that required for handling ships, maneuvering fleets, etc., will avail us nothing when it comes to war if we have not learned the game, that is, if we do not know how to handle naval

forces, both strategically and tactically, at least as well as our opponents.

This game, like all other games, can be learned only by playing it. The mere study of the art of war, even though very thorough, will no more make you competent in the practice of strategy and tactics than book knowledge of golf and tennis will make you good players. It is for this reason that the college insists not only upon the study of the art of war, but also upon the practice of it in chart maneuvers and upon the tactical game board.

You will find that by playing these practical games you will gradually acquire confidence in your ability to estimate a situation correctly, reach a logical decision, and write orders that will insure the mission being carried out successfully.

When you can do this you will have accomplished that which it is the principal function of the college to teach. And having accomplished this, I hope you will not consider that you have thereby ceased to be practical officers. Also that you will not knowingly allow others to consider you "highbrows."

There has been wasted during this war a great deal of effort, much valuable material, and even many valuable lives because of the lack of training necessary to reach logical decisions based upon the well-known immutable principles of war. This is not the time or place to inform you of these incidents. But let it suffice for me to assure you that the constant prayer of those who bear great responsibility in time of war is that they may be spared the results of the decisions of the so-called practical officers who are ignorant of the art of war and who have not been trained to think straight—that is, who have not been trained to make a a logical estimate of a situation.

Though we are now beginning a new course, it should not be assumed that there is at present anything original about it. We are beginning where our predecessors left off. It would be presumptuous for us arbitrarily to make changes in the course in the absence of experience upon which to base such changes.

The essential results so far attained were due to a long process of development. Improvements were continuously made until the results demonstrated that the course and the manner of conducting it were accomplishing the college's true mission of turning out officers reasonably well instructed in the art of war and trained in its application.

This development was not due solely, or perhaps even chiefly, to the staff, but was greatly aided by the criticisms of the members of the various classes, based upon their various experiences.

Remembering that we are practically a fleet board for improving our efficiency in making war, it follows that criticisms of college methods are more than welcome, provided they are based upon the experience of those who have taken the course. It is recognized as natural that officers coming to the college for the first time will not always understand the reasons upon which the methods of instruction are based, and will therefore be inclined to criticise them. But as sound conclusions can be safely based only upon adequate knowledge and experience, it would manifestly be unprofitable to consider the criticisms of officers who are just beginning the course. It is for this reason that the college does not invite suggestions as to changes in essential features until after the students have finished the course.

Note that the above refers only to suggestions as to essential features of the course, and not to minor suggestions which may occur to you from time to time. We recognize that these may be very helpful, and we shall be glad to receive them. For example, suggestions concerning mechanical features of the tactical and strategic maneuvers are more likely to occur to the newcomers than to those who become familiar with these methods through constant use.

At one time we invited the criticisms of the beginners and also of the graduates. First as a student and then as a graduate I took an active part in these criticisms, and my experience showed my criticisms as a beginner to be unsound.

Perhaps an account of this experience would be more or less convincing. It is contained in a letter which I wrote to Admiral Knight when he was about to assume the Presidency of the War College in 1913. The letter is as follows:

TORPEDO FLOTILLA, ATLANTIC FLEET,
U. S. S. "DIXIE,"
Newport, Rhode Island,
11 October, 1913.

My dear Admiral:

A few days ago I had a significant experience at the War College; and when I learned that you were to be ordered as President, it occurred to me that I might send you an account of this experience on the bare chance that it would be of some use to you.

The occasion was the usual conference held on the last day of the summer course for the purpose of discussing the advisability of making changes in methods of instruction.

As usual upon these occasions, certain of these methods were opposed by some of the student officers, and were supported by the staff and by a number of former staff officers and officers who had completed the long course and who had been invited to attend.

The principal point at issue was as to the advisability of continuing that feature of the present applicatory system of instruction during the long course which requires the student officer to show, by written theses on the various subjects and by written solutions of the various problems, that they are continually making good, that is, that they really understand each subject.

Generally speaking, the result of the discussion showed the following significant conditions:

1. Practically all of the candidates for the long course held that all the writing required was largely a waste of time; that if this were eliminated there would be more time for reading, for study, for instruction, for war games, etc.

2. Without exception, all those officers who had taken the long course, or who had served on the staff, strongly supported the present methods of applying the applicatory system.

3. With, I believe, no exceptions, all these latter officers had, at the beginning of their long course, opposed the methods they now unanimously approve.

I am one of those who were originally in opposition. At the conference in question I therefore had the peculiar experience of listening to the new men putting up the very same arguments which I had used against the system two years ago, and which I, and all those who took the long course, now recognize to be wholly in error.

From this experience it would seem evident that, as might be expected, only those who have taken the long course as now conducted are competent to express an opinion of value as to the benefits to be derived therefrom.

Of course there must be the adequate amount of reading, study and instruction now provided by the course; but it is my opinion that any course of instruction which is not based upon the applicatory system as now applied—that is, which does not require the student to show that he is making good—is of relatively small utility in *training* officers in the *practical* application of the principles of warfare.

I tried to make this point clear in a lecture which I delivered at the Naval Academy and which was subsequently printed and circulated in the service.

Congratulating you upon your detail to this important duty, believe me,

Very sincerely yours,

WM. S. SIMS.

Rear Admiral A. M. Knight, U. S. N.,
Commanding Atlantic Reserve Fleet,
U. S. S. *Wisconsin*, Navy Yard, Philadelphia, Pa.

This is specially important in the case of decisions made in carrying out tactical and strategic maneuvers, for, manifestly, if the college cannot even assume that its own staff's solutions are superior to those of the members of its classes, it cannot properly be asked to assume the ability to pass judgment upon the decisions of those who conduct the maneuvers.

Moreover, to place the college in such a position would result in a conflict of opinions with the inevitable result that antagonism would be created between the college and the service—and if the college is to succeed in teaching the art of war to willing pupils, it must at all times work in complete harmony with the service.

There is one other subject which has received too little attention heretofore, and that is the extremely important quality called "military character."

Some officers have admirable knowledge and experience but fail in this quality of character. They are honest, loyal, zealous, and devoted. They know the principles of warfare but do not always exercise the will and self-control to apply them. They understand the principle that in extensive organizations work should be divided according to specialties and the head of each section given full responsibility and authority, but they do not apply it—hesitating to allow authority, even in minor matters, to pass out of their hands. This subject will be taken up in due course. Its importance is due to the fact, often demonstrated, and particularly so in the great war, that not infrequently officers of quite exceptional ability, knowledge, experience, and energy failed to succeed because they did not understand, or did not apply, the principles of military character.

The service is to be congratulated that the Navy Department has decided to increase the capacity of the college. The Secretary of the Navy has just signed an order which indicates the desirability of every effort being made to provide a staff of thirteen officers, and a class of thirty student officers in June and January, thus adding sixty trained officers to the navy each year.

Though it may be possible in the future to increase this number somewhat, still it can never be sufficiently increased to include the entire commissioned personnel. But as it is necessary that the essential principles and methods taught by the college be understood by the service, it is apparent that opportunity to acquire this knowledge should be provided.

To this end the college offers to all officers the advantages of a correspondence course, the extent of which is limited not by what the college can provide but by the average time which can be devoted to this work by officers occupied in the various duties ashore and afloat.

While we may reasonably hope for very appreciable results from this course, still there can be no doubt that we must depend largely upon graduates to illustrate by their example the principles and practices they have learned at the college.

Judging from my own experience, you will find your studies at the college of absorbing professional interest; and you may be sure that it shall be my object and that of the staff not only to facilitate your work in every practicable way, but also to render your stay here as agreeable as possible.

In the confident hope that we may succeed in both of these objects, I take great pleasure in welcoming you to the college.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

Prize Essay, 1917[1]

COMMERCE DESTROYING IN WAR

By Captain Lyman A. Cotten, U. S. Navy

Motto: Easy methods; inconsiderable results

The science of war as we know it to-day, like all other sciences, is the result of progressive development. As war implements changed by successive stages from the clubs and stones of savagery to the high-power guns of to-day, the method of using these implements necessarily changed also, but the object of war has constantly remained the same, namely the reduction of one's opponent to such a state of impotence, actual or prospective, that he considers it the part of wisdom to submit to the will of his enemy.

Since war ceased to be a general *mêlée* in which one savage tribe fell upon another and fought by brute force until one was exterminated or enslaved, man has been more and more seeking to employ his brains as an aid in fighting. Many have reaped the advantage of more effective weapons or a more effective use of their weapons, but many more have striven in vain for a short cut to success in war—some patent nostrum by which victory could be won without taking and giving the hard blows that make war so disagreeable.

In the early ages of human development, sea-borne commerce was practically non-existent, but, so soon as civilization reached the era of colonization, it quickly became an important part of the economic life of the countries that faced the sea, and consequently of great importance in war.

[1] Essay received by U. S. Naval Institute, December 30, 1916. This essay was awarded the prize in 1917, and was through error published in a deleted form. It is now published in its entirety because a large and important portion of the essay was omitted in the June issue.

A merchant vessel on the high-seas is particularly helpless to resist force, and furthermore constitutes, with her cargo, a concentrated form of wealth. The sea offers no facilities for concealment, and the lanes of maritime commerce converge in certain localities on account of physical features, as islands, straits or smaller seas, making the location of merchant ships fairly simple. Seeing this, some seeker for success-in-war-without-fighting evolved the idea of commerce destroying as the long-sought short cut to easy, economical and successful war.

He argued in this way. We will build ships of less cost than heavy men-of-war, and send them out to prey upon this helpless maritime wealth of our enemy. These ships will infest the regions in which his merchant ships converge, and by capturing or destroying them we will bring him to the verge of bankruptcy, at the same time enriching ourselves at his expense. This reasoning seemed plausible, and this means of winning war on the sea appeared to be both simple and economical, and straightway there arose a school of adherents, both naval and civilian, though it must be said that it always appealed with more force to those who *direct* the conduct of war than to those who have to execute it. In any case, from that day to this, most maritime wars have seen commerce destroying used with varying degrees of insistence.

That great student of naval history Admiral Mahan said, " There are certain teachings in the school of history which remain constant," and it would seem to be not without interest to see what lessons the school of history contains on commerce destroying in war, with special attention to its final result and its association with victory or defeat. Such lessons should be of particular interest at this time when commerce destroying is being undertaken on an extensive scale and a new instrument, the submarine, is being employed in its service.

A survey of the history of commerce destroying will necessarily have to be very brief to be compassed in reasonable space, but even so, we may be able to deduce something therefrom of value to our country and of interest to ourselves. Such a survey may be divided logically into two parts, *i. e.*, commerce destroying in former wars and commerce destroying in the present war. By handling the subject in this way we may more accurately gauge the present by the known results of the past, and after all such a

a survey can only have real value in just so far as it leads to a clearer understanding in the momentous present.

It is not necessary for our purpose that we go back in history for a further period than to enable us to cite sufficient examples upon which to base our deductions with reasonable safety. By the middle of the sixteenth century maritime commerce had risen to a position of great economic importance in the national lives of several European countries, particularly Spain. Her galleons usually voyaged several together, the better to defend themselves from the pirates and freebooters of that day, and on their homeward voyages were laden with cargoes of great value.

When England under Elizabeth and Spain under Philip went to war, partly for "the glory of God," and partly for the privilege of trade with America, the Spanish Navy was at the height of its glory, while the English Navy had yet to win its distinction, and to become imbued with those correct principles of naval warfare that for so long have maintained England in her world position. At this time England was a comparatively poor country, and first-line men-of-war were expensive, so for some years she made direct war on the commerce of Spain her chief objective, at the same time pillaging and destroying her colonial cities as occasion permitted.

At first this mode of warfare seemed to meet with considerable success, but, none-the-less, when Philip began building and fitting out a vast number of fighting ships, England found herself threatened with invasion, *which commerce destroying was powerless to stop*. Though Drake covered himself with glory when he "singed the King of Spain's beard for him" at Cadiz, the preparations for invasion were only delayed, not stopped.

After much delay through vacillation and economy, the English began to prepare a fighting fleet, and finally were able, though vastly outnumbered, to "defy the Duke Medina" and scatter to the winds the Great Armada.

Then it was that the English found that in saving England from invasion *by destroying the Spanish war-fleet*, they had also greatly simplified the problem of trade with America, and had put the commerce of Spain almost at their mercy.

For fifty years or more after this, England put her reliance in maritime war in her fighting fleet, but plausible fallacies die hard, and in the second Anglo-Dutch war the English showed they had

only half-learned their lesson. Charles II, as usual, was short of money and, besides, the war was waged primarily over the question of maritime commerce, so again England made direct war on commerce, though several fleet actions took place. In these actions the English Navy, while winning no decisive victories, still maintained its position very satisfactorily. After the battle off the North Foreland, Charles, for purposes of economy, decided to put most of his fighting ships out of commision, and concentrate upon commerce destroying. The ineffectiveness of such action may be clearly seen, since the Dutch fleet entered the Thames River in 1667 and inflicted enormous damage, and England was quite willing to come to terms of peace containing no advantages for herself, except escape from the then vastly superior Dutch fleet.

England wholly learned her lesson this time, and not since the Peace of Breda, signed after De Ruyter's raid up the Thames, has she used commerce destroying as a primary mode of maritime war. On the contrary her own commerce has been attacked directly a number of times, but nevertheless it has continued to grow until it has become greater than that of any other country.

France has been the most faithful adherent of commerce destroying, having used it intermittently in her naval wars for over a hundred years. Over and over again it was demonstrated that it led to no considerable military advantage, but still she clung to it with a tenacity worthy of a better cause.

In the third and last Anglo-Dutch war, in which France was allied with England, each of the powers used their fighting fleets, rather than commerce destroying, and finally the Dutch sea power was destroyed and with this destruction Dutch commerce was *automatically* toppled from its pedestal of supremacy.

Again in the War of the League of Augsburg we see France taking the sea with fighting fleets and England, now allied with the Dutch, was partially defeated at the Battle of Beachy Head, though the next year Admiral Russell took the sea with a greater force than Tourville could gather. However, by skillfully handling his fleet Tourville drew the English fleet well out into the Atlantic, and during its absence the French light cruisers fell upon English commerce and inflicted enormous damage.

During this campaign, it should be noted, there was no actual fighting, and yet the injury to England was considerable. Here

we probably have the origin of the French belief in the efficacy of commerce destroying as a primary mode of warfare on the sea. "Why," they argued, "have expensive fighting fleets when such injury can be done our enemy by cheaper cruisers and privateers." They quite overlooked the fact that their main fleet, by drawing off the English fleet in pursuit, gave to their cruisers the temporary immunity that enabled them to operate successfully.

The following year the French fleet was badly worsted at La Hogue, but direct war on commerce was continued on a scale previously unknown. Gradually, though, as the French Navy declined in fighting ships, their commerce destroyers were chased from the seas, and with sea control in England's hands French maritime commerce disappeared and its place was taken by England's increasing fleet of merchant vessels. As the disparity in fighting ships increased it became progressively more dangerous for the French commerce destroyers to go to sea, and more difficult for them to make captures even when they could keep the sea.

The part of a commerce destroyer is to destroy merchant vessels, not to fight, and consequently French commerce destroyers were usually so busy keeping out of the way of English men-of-war that they had but little opportunity to ply their vocation. Where the lanes of commerce converged, and captures should have been easy, England stationed men-of-war more powerful than commerce destroyers and the French ships had to seek their victims in more sparsely traversed regions where captures were few. The peace terms were most humiliating to Louis XIV, and his comparatively successful war on commerce was in no way comparable to the *military* success on the sea of his enemy.

When the war of the Spanish Succession began France at first tried squadron warfare in rather a half-hearted way, but the ease and seeming economy of war on commerce again lured her away from the true principles of naval warfare. During the first five years of the war France captured or destroyed, on an average, about 230 English ships per year, but England captured more French ships during that time, though her fleet was primarily engaged in military operations that were not without great influence in leading up to the treaty of Utrecht, so disastrous to France. The individual exploits of some of the French privateering commanders were illustrious, but none-the-less the end of the

war found France humbled and defeated and English sea power with its protecting wing at its height.

In the war of the Austrian Succession the naval history of the war of the Spanish Succession in effect repeated itself. France started off as though to fight her part in the war on the sea, but soon commerce destroying was again the accepted mode and the treaty of Aix-la-Chapelle in 1748 restored to France none of the concessions made by the treaty of Utrecht.

In the Seven Years' War, between France and England we see another deplorable result of seeking an easy mode of warfare, for though the French fought on occasion, they were ever on the defensive—always willing to await the attack of their enemy—rather than seeking in aggressive action to deliver the heavy blows necessary to overcome an enemy, even if heavy blows have to be accepted in doing so. They seemed to have thought that by making a *pretence* of fleet warfare they could impart the element needed to make commerce destroying effective as a means of bringing their enemy to terms.

It is quite true that England suffered the loss of many merchant vessels, but French commerce was practically denied the use of the sea by the English fleets, and, after all, the percentage of loss to the English was small. Her ships were now carrying both her own normal commerce and that abandoned by France. The financial loss to England was scarcely more than a small war tax upon maritime commerce, never amounting to more than three or four per cent per year. In the meantime England was taking the French colonies one by one, far more than compensating herself in a financial way for the small war tax, and at the same time establishing the foundation of the British Empire.

The treaty of Paris in 1763 left in English hands Canada, Nova Scotia, the Ohio valley, the country east of the Mississippi to New Orleans and numerous small West Indian islands, and *a navy powerful enough to keep them.* The practical results of France's war on English commerce were absolutely without effect when it came to signing the treaty of peace. Comment is unnecessary.

In the maritime part of the War of the American Revolution, France swung away from war on commerce and rather consistently followed squadron warfare, but the infection of non-aggressive action was still there as a legacy from the less rigorous mode

of warfare. Still the results of the war were much more satisfactory to France than were those in which war on commerce had been accorded a more prominent part.

It is nothing short of remarkable that the French, after their years of failure to attain any material advantage through war on commerce, should again revert to it, yet they did no less. In the French Revolution the Committee of Public Safety announced "The new system of political warfare that your committee has adopted. . . . . All our plans, all our cruises, all our movements in port and at sea, will have for object only to ravage its (England's) commerce, to destroy, to overturn its colonies, to force it finally into a shameful bankruptcy." That this system was termed new, can only be attributed to an utter lack of familiarity with naval history in general and with French naval history in particular.

It cannot be denied that for some years many English merchant ships were captured and it was doubtless a source of annoyance to English merchants, but the monetary value of these ships was but a very small part of the total expense of war, and during these years, despite captures, English commerce actually increased. The "shameful bankruptcy" failed to materialize. As a matter of fact the French captures per year averaged only from 2.5 to 3.0 per cent of England's merchant fleet, which does not seem a very heavy war tax.

In the Napoleonic Wars, the French, though their military operations were directed by a master mind, still hoped to gain some advantage through war on commerce at sea. They fought several memorable fleet actions, it is true, but they were always the attacked, and it would seem as though the hearts of their seamen were ever longing for some less violent form of warfare, some easy mode of success, some method of "making war without running risks," as Napoleon himself said. For several years after Trafalgar, war on commerce was followed with energy and persistence, but one by one the French cruisers were sunk, captured or wrecked, and their own shipping, lacking the protecting influence of fighting squadrons, practically disappeared from the high seas.

The numerous examples from French history have been cited, because for a hundred years there were practically only two naval powers, and their modes of conducting warfare were

diametrically opposite. England, profiting by the lessons learned from her wars with Spain and Holland, took the sea, whether inferior or superior in numbers, ready and eager to fight, and her objective was ever the fleet of her enemy. France over and over again sought by inconclusive maneuvers and commerce destroying to bring her enemy to terms. The known results of the various wars individually, and the cumulative total of a hundred years, illustrate more clearly than mere words may hope to do, the strength of the one method and the weakness of the other. It may be accepted as a maxim of warfare that what is worth having is worth fighting for, and easy methods lead to inconsiderable results.

Only a few more examples of commerce destroying prior to the present war will be mentioned, and these only because being less remote historically, they are more generally familiar, and because one famous example of war on commerce is of particular interest to Americans.

During our Civil War the South, having but few men-of-war, used them largely in warring upon the sea-borne commerce of the North. Three ships, the *Florida,* the *Shenandoah* and the *Alabama,* were particularly successful, but the importance of their operations has been vastly magnified by the romantic appeal of their careers, and the concurrent decline in American shipping that has lasted to the present time.

The *Alabama* was the most celebrated of these commerce destroyers, and yet she averaged only three captures per month, and the total loss by capture of the commerce of the North during the entire war, according to a Congressional investigation made soon thereafter, was only five per cent of the whole, or one and one quarter per cent per year. This does not impress one as being an exorbitant war tax on any branch of commerce. That these commerce destroyers were able to accomplish even as much as they did was due more to faulty methods of commerce protection on the part of the North, than to any inherent value in this mode of warfare.

While the commerce of the North was very seriously injured by the direct attack upon it, it is generally lost sight of that the commerce of the South was practically prohibited on the high-seas by the purely military disposition of the Northern fleet. That this military disposition was a most effective factor in defeating the

South, no one familiar with the history of the Civil War can doubt. At the same time it is highly improbable that the total result of the Southern commerce destroyers prolonged the losing struggle of the Confederacy by so much as one day, nor would the result of the war have been different had there been a hundred *Alabamas*—so long as they were used purely as commerce destroyers.

The permanent decline of American maritime commerce was due much less to commerce destroying than to legislative, economic and fiscal causes subsequent to the war.

In the Spanish-American War neither combatant had a merchant fleet worthy of the name, and so it affords no examples of war on commerce, though our men-of-war, of course, captured such Spanish merchant ships as came their way. The war was in effect concluded by the destruction of the Spanish fighting squadrons at Manila and Santiago.

In the Russo-Japanese War the Russian division based on Vladivostok made several raids on Japanese commerce, in one case getting as far down as the entrance to Tokyo Bay, but the influence of these raids on the final result of the war was absolutely nil. The Japanese refused to draw any part of their main fleet away from their strictly military objective—the Russian fleet of fighting ships in Port Arthur.

Even in this mere outline sketch of commerce destroying in past wars, it may be seen that certain facts repeat themselves with such consistency that we can but conclude that they belong to the constant teachings in the school of history. We see that commerce destroying has ever been used by the nation having the weaker navy—weaker in fighting ships, in morale, or in the willingness to run the legitimate risks of normal war on the sea; that the main incentives to such warfare are economy and the longing for an easy way to success in war; that the surest way of accomplishing the ruin of an adversary's commerce is to destroy the fighting force that protects it, rather than to make direct war on commerce; that commerce attacked directly sometimes actually increases in war, when protected by adequate fighting ships properly used; that at its best commerce destroying has been able to inflict no more than a small percentage of loss on an enemy's total maritime commerce; that the monetary loss to an enemy caused by attacking her merchant ships has never amounted to more than a very small

fraction of the cost of war; that an enemy country has never been brought to the verge of bankruptcy through attacking its commerce; that war on commerce has never produced concrete results of moment tending to reduce an adversary to a state of impotence; and finally that commerce destroying has consistently been practiced by the nation that was, sooner or later, defeated in the essentials of the wars in which this form of warfare was employed.

It is hardly within the bounds of reason that the foregoing clearly discernible facts should have been merely coincidental. There must be some reason for the results, and when these results are similar again and again this reason must be fairly constant, if not fundamental. The results in war are after all the essential things, and when a mode of warfare fails to produce results the reasons for its adoption cease to be of particular interest.

So it is beside the question to advocate commerce destroying in war on account of its original economy, for on the whole its operation is very uneconomical, looking at the war as an entity rather than as a number of parts; it is of no moment to state that war on commerce will reduce an enemy to bankruptcy, since it has never done so; it is futile to the extreme to employ such warfare hoping to win victory thereby, since the history of a hundred and fifty years and more show it to have been ever associated with defeat.

It is not intended that the conclusion is to be drawn that the final results of the various wars were absolutely determined by the types of naval warfare employed, but beyond question the successful use of sea power did have a great influence in each case, and direct war on commerce does not seem to be the most advantageous use of sea power. Since the war is conducted by force it must be terminated by the destruction of force, and so far no easy method of accomplishing this has been evolved.

War on commerce has its uses, for it annoys and weakens an enemy, but as a primary, peace-compelling undertaking it does not produce military advantages of importance. The best way for a combatant nation to protect its own commerce and at the same time drive the commerce of its enemy from the sea, is to destroy the fighting ships of that enemy. That much is certainly true if we are to accept the lessons of history up to the present time, and we are safe in assuming that it will remain true until basic conditions have changed or some new method or instrument in com-

merce destroying is utilized that fundamentally changes the problem.

From the foregoing we are forced to draw certain conclusions as to the efficacy of commerce destroying in past years, judgment being based solely upon the cold and impartial historical record. As historical repetition is accepted as a truism one might have expected to see in a modern war an effort made by one or more belligerents to utilize direct war on commerce as a means to a military end. Therefore it should occasion no surprise to find one of the belligerents in the Great War undertaking direct war on commerce on an extensive scale. There can hardly be any doubt but that the history of such warfare is thoroughly familiar to that belligerent, but at the same time it is only reasonable to suppose that she thinks there is some new or peculiar condition that may give to such warfare the power of inflicting such damage to the military situation or wealth of her enemies, that it will have the effect of forcing a peace under terms favorable to herself, or this form of warfare has been adopted because of the belief that other and more dangerous forms would be doomed to defeat, the effect of which would react to greater disadvantage than the failure of war on commerce to produce important military results.

It would seem promising of interest to review briefly commerce destroying in the present war to date, from the view-point of a neutral outsider, with the objects of ascertaining the points of similarity or difference between what the history of commerce destroying in former times indicates might have been expected, and what has actually happened. Then, if basic conditions have not changed, and the employment of a new instrument of warfare against commerce has not fundamentally changed the problem, we may deduce what *history* teaches us to expect as the final result of commerce destroying in the present.

It is clearly understood that discussion of war-history in the making is highly precarious, for data is frequently either purposely withheld or intentionally distorted, and many factors of importance at work in the present can only be clearly seen when their results are viewed as of the past. At the same time it is believed that by waiting, much that may be gained in accurate knowledge may be lost in vital, living interest.

For our purpose it will be necessary to consider the war as between England and Germany only, since Germany is the power

most directly waging war on maritime commerce, and the greater part of that attack is aimed at England.

When war was declared the German Navy found itself inferior to that of England in all parts of the world. Not having the protection afforded by fighting fleets capable of maintaining themselves *at sea,* German maritime commerce practically ceased from the day war was declared, as her ships in all parts of the world scurried to friendly or neutral harbors. At the same time English merchant ships, with but few exceptions, continued their voyages, reassured by the knowledge that in whatever seas they were cruising, the protection of the English fleet followed them, though, of course, not in absolute degree.

As has been done in former wars, the ships of the inferior navy in remote regions turned their attention to commerce destroying. There were seven German commerce destroyers that accomplished enough to entitle them to be taken into consideration, and of these the *Emden* in the Far East and the *Karlsruhe* in the Atlantic were by far the most successful. These ships were handled with boldness, courage and zeal, and yet their claim to distinction is based much more on the romantic appeal of their war careers than on any practical military results accomplished by them.

At first these commerce destroyers inflicted considerable damage on English commerce, but one by one they became entangled in the far flung net of English sea-power, and were destroyed or forced to intern in neutral harbors. During the eight months that it took to account for the seven commerce destroyers, they destroyed between 30 and 35 million dollars worth of English commerce. This is certainly no inconsiderable sum, but after all it is only about seven-tenths of one per cent of England's sea-borne commerce during the same period.

Despite the activities of the seven German cruisers English maritime commerce was never more active. All the necessities of supply from overseas of food-stuffs and other essentials were met, and the effect on the English *military* situation of the German attack on commerce was practically nil. The loss occasioned was almost solely monetary, and, as we have seen, this was not relatively great. In the meantime, all German maritime commerce had ceased, except in the Baltic where from particular circumstances the influence of England's sea power was not effective. Capture of German merchant ships had not been the cause of this cessation

but the control of the sea, by the English Navy made the certainty of capture sufficient to keep German ships off the high seas.

The great focus of all English commerce is, of course, England, and if an effective attack could be made in English waters it would seem to promise the greatest prospects of producing important results. These waters are very close to German fortified bases, which would tend to increase the effectiveness of war on commerce there, but these factors are largely nullified by the fact that there also is the great concentration of England's sea might. An attack on English commerce in the waters adjacent to England along the usual lines of war on commerce was clearly impracticable. The rich field was there, close at hand, but the problem was to find a way of utilizing this field. Hence it was that Germany evolved her scheme of using submarines in an effort to gather the harvest in the nearby, rich fields where English commerce concentrated, and where it was, more than in any other part of the world, essential to England's military well-being.

Since we are looking at the matter solely as neutrals and from the military point of view only, it is no part of our discussion to inquire into the legality, the humaneness, or the methods of practice employed in the use of this submarine war on commerce, but the effectiveness, the probable results and the wisdom of such warfare are most germane to our subject.

In the early part of the war German submarines were used to attack enemy men-of-war, and considerable success attended their operations, but soon the English fleet learned how to nullify, to a large degree, their effectiveness. For some months thereafter the submarines can hardly be said to have paid for their fuel. Some enterprising submarine commander, in the absence of anything else that he could accomplish, held up and captured a merchant ship, and the seed of submarine war on commerce was planted.

On February 4, 1915, the German Admiralty issued its now famous order which said, among other things:

> The waters around Great Britain and Ireland, including the whole English Channel, are declared a war zone from and after February 18, 1915.
>
> Every enemy merchant ship found in this war zone will be destroyed, even if it is impossible to avert dangers which threaten the crew and passengers.

No mention of submarines was made in this order, but its wording, and the well known naval conditions in the North Sea and

adjacent waters at that time, clearly indicated the character of the war on commerce that Germany was launching. Thus the submarine entered into her rôle of commerce destroyer—a rôle little thought of in her original design or her subsequent development.

It may assist us in our estimate to recall the fact that Germany, when she announced her intention of launching her submarine campaign, did not claim as justification for it that it would be likely to produce important military results, but announced that it was in the nature of reprisal for certain acts on the part of England. Furthermore, it is quite probable that Germany, with her clear understanding of military values, has not expected and does not now expect the results of the campaign to be productive of great military results, though hope may be entertained as to its moral effect both at home and abroad.

It may be well to inquire here if there is any property of submarines that indicates that their use as commerce destroyers changes, to any great degree, the general problem of war on commerce as practiced by various nations for a hundred and fifty years. From a superficial examination it would seem as though such were the case, but upon deeper inquiry the effectiveness of the submarine as a commerce destroyer is found to be much more apparent than real. The ability to submerge is an advantage in that it aids in concealment and protection, but at the same time it enormously decreases vision and speed, both very essential for effective commerce destroying.

On account of the physical limitations of submarines they are easily injured or disarranged and a slight injury or disarrangement may be fatal. Compare the relative effect on a submarine and on a fast cruiser of to-day or a fast frigate of the past, of a shot hole, or a steel net or slight disarrangement in motive power, and the limitations of the submarine as a commerce destroyer are at once apparent. The ease with which she may be damaged even by a merchant vessel, very materially limits her ability to board and determine the character of a suspected vessel, and in even moderately heavy weather she is badly handicapped in every way. The size of crew carried by a submarine makes it impracticable for her to send in prizes under prize crews. She can only destroy her prizes. Thus while she can subtract from the wealth of her enemy, she cannot add to that of her own country. A commerce destroyer has always to keep careful watch for two things—her prey and her

enemies, to capture the one and to evade the other. To enable herself to evade, the submarine has necessarily to reduce her ability to capture. Certainly up to the present the submarine has not demonstrated that it has changed fundamentally, or even in marked degree, the problem of commerce destroying.

The general non-military opinion as to the effectiveness of the submarine as a commerce destroyer is largely due to the fact that submarine exploits have been considered by the newspapers to have great news value and have been featured because the submarine was a new instrument of war, its employment in commerce destroying was unexpected and its humanitarian side gave to it an interest that its military accomplishments did not warrant. It may be pointed out that the reason Germany is using the submarine in her war on commerce is not necessarily or even probably because of a high opinion of its efficiency as a commerce destroyer, but under the circumstances it is the only instrument that she can employ for that purpose.

As to the material results accomplished by submarine commerce destroying it is possible only to approximate roughly, but after reconciling various estimates and remembering that most of them are of British origin, or based upon British data, it is possible to get an outside figure that should cover the loss per month, and it is worthy of note that the rate of loss per month for the last five or six months approximates the average monthly loss for the entire war.

Lloyd's Register for 1915-16 gives the total number of British ships, including colonies, as 11,353, with a tonnage of 21,274,064. The New York *Journal of Commerce* gives as the total British losses for 26 months of war as 874 vessels displacing 1,853,002 tons. Thus approximately 8 per cent of the entire number of British merchant ships, and 8.5 per cent in tonnage has been sunk or destroyed by belligerent operations. The average monthly loss has been just over 71,000 tons. When war began shipping was worth about $45 per ton. Now it is worth three times that. Taking $90 per ton as the average, the loss to British shipping for the first 26 months of the war has been over six millions of dollars per month.

To the above must be added the cargo value. Here there is no exact data available. One British source estimates the cargo loss during the first year of hostilities as only 1 per cent of England's

imports and exports; a total for that year of only 64 million dollars. This seems too low an estimate, yet there seems no way to refute it. Last year 19½ million tons of British shipping (omitting ships owned in British colonies) carried the greater part of 6400 million dollars of England's exports and imports. Thus each ton of shipping carried $328 in commerce *in all of its voyages*. Assuming British ships to average five complete voyages per year, the cargoes lost would total in value only about 55 million dollars, and five voyages per year would seem a conservative average even though British ships seek cargoes far from home. It would seem then that the 1 per cent estimate is after all reasonable. This makes the cargo loss 5⅓ million dollars per month, and the total direct loss to British shipping under 12 million dollars per month, as an extreme covering figure. This is over a third of a million per day. If viewed alone, the loss of a million dollars every three days seems a big loss, but looked at in conjunction with other things it loses its apparent importance, and if unaccompanied by military factors it may be discounted easily as we shall see.

Each day of war is costing England, according to the most reliable figures, about 28 million dollars, so the loss in maritime commerce is adding to this cost about 1.4 per cent. This loss is financial only. The military loss is impossible to estimate, for no data is available as to what military supplies are being carried on the various ships sunk. We do know, however, that the desire is to so seriously interfere with England's commerce that her military activities will be seriously embarrassed, and that her people will feel the pressure to such an extent as to make them desire peace, even on terms dictated by Germany.

It is a matter of common knowledge that England is getting from overseas an enormous quantity of food stuffs, general supplies and munitions of war, and, since the beginning of the submarine commerce destroying campaign, of those things essential to her military and economic well-being, the quantities received have probably increased rather than decreased. We know further that England is supplying her military forces in a number of places both near and remote. In other words *her lines of communication are intact,* despite the efforts of German submarines. Of course, her lines are not absolutely inviolate, but her losses are relatively small, and they may be cheerfully and philosophically borne as the fortune of war. To whatever extent this form of warfare is

carried, and however many merchant ships England may lose, until and unless her lines of communication are seriously interfered with or threatened, the military effect of the attack on her commerce will be relatively small.

Thus we see that the direct military result of the attack on England's commerce, while not negligible, is of small moment. There remains then only the financial loss. Let us see what economic effect this may have, and, through this, the *indirect* military effect.

England has, for many years, been supported primarily by her overseas commerce, and to cut off her intercourse with other nations is to shatter her economic national life. Furthermore, in the present age England is absolutely dependent upon other countries for much of her food supplies, and very largely dependent upon neutrals for many of her military necessities. For a belligerent to cut off England from outside intercourse is to bring her to terms very quickly. But this is only the statement of the problem; it in no way indicates its solution. It was on account of these very reasons that England maintained her sea power, that she might command the seas. This she has done, and the attacks of submarines is no more than a form of guerrilla warfare—annoying, but not decisive. The fact that Germany's commerce is no more seen, and that England's merchant ships continue to ply their trade upon the seven seas is not changed one mite by the activities of Germany's submarines, but is solely dependent upon the overpowering influence of England's fighting fleet in being.

The monetary loss to English commerce, and thus to England, remains for consideration, and 144 million dollars a year cannot be slightly dismissed, even in this age of enormous financial resources. May not this financial drain upon England in time have appreciable effect upon her military power? Let us see how this loss of shipping reacts upon the national life of England.

When war was declared in August, 1914, England's merchant fleet was worth in round numbers, something over 1000 million dollars. When English sea power automatically swept German commerce from the seas, by forcing it to remain in friendly or neutral harbors, it increased the value of English shipping by certainly 50 per cent. Thus before a real blow was struck, there was added to the value of English shipping an amount equivalent to the losses inflicted by more than three years of submarine

attacks, and this sum was a real income-producer, collected by increased freights the world over. Further than this, each merchant ship destroyed by submarine attack or otherwise, adds to the value of those remaining, and adds to their earning capacity until now England's merchant fleet is worth nearer three than one billion dollars. This remains true of English merchant ships only so long as England has command of the seas, and her ships are enabled to ply their trade without undue risk.

It may be recalled here that the term "command of the sea" does not necessarily mean absolute safety from capture, but such a predominance on the sea that one's undertakings are reasonably secure from an enemy, while enemy undertakings are attended with grave danger. Such command of the sea England now has, and has had since the war began, and Germany's submarine warfare has been no more than a threat to this command. It has by no means changed it.

In this connection it has been stated that by constructing and operating mercantile submarines Germany has overcome or broken England's command of the sea. The absurdity of such a statement need not be pointed out to naval men. The very fact that Germany has been forced to build mercantile submarines in order to get a few hundred tons of freight into and out of Germany is the very highest tribute to England's command of the sea.

Despite the foregoing there is still financial loss to England as a whole through the losses inflicted upon her shipping, but this loss she has means of nullifying so far as it may indirectly affect present military affairs. By one peaceful undertaking she floats an enormous external loan, and recoups herself for the losses she has suffered in a financial way. Thus she avoids the indirect military effect of such financial losses by charging them to the future. Of course, the economic results of these loans on the future may be enormous, but they are outside of our scope, which is to determine the *military* effect of war on commerce. Anything to have military effect must operate in war, and thus financial losses which may be charged to the future are rendered innocuous from the military view point.

In this connection it may be noted that as England in former wars took from France her colonies, one by one, while France was dissipating her naval energy in campaigns against merchant ships, so now she is taking, or has taken, the colonies of Germany. The

English ships sunk by German submarines are lost to the world, but the German colonies taken by England are still factors of great importance, either in making terms of peace or in aiding in the *post bellum* financial rehabilitation of English economic life.

If financial loss be made sufficiently great and sufficiently widespread to bring suffering or extreme deprivation upon many individuals, it may have military effect by damping the general zeal for war or even by arousing a willingness to make great concessions for peace. In the case of the financial losses here considered, we have seen that the very interests that suffer the losses are the ones that to a certain degree have these losses compensated. In this age maritime losses are very generally distributed by means of insurance, and there are no indications of real suffering brought on by maritime losses at sea.

The effect of this form of warfare on the morale of those practicing commerce destroying is, of course, speculative, but it is highly probable that a navy that systematically practices war on defenceless merchant ships almost exclusively for any length of time, will deteriorate in those characteristics that distinguish virile, courageous, manly naval personnel. When the French Navy was for so long practicing direct war on English commerce, the morale of her navy was at its lowest ebb. That this was not racial is at once apparent when we recall that during this same time the morale of the French army was above reproach.

We know that heroic action develops the capacity for heroic action, and the development of military character is very largely dependent upon the nature of the service one is required to render. Some day when fleet meets fleet in a final struggle for supremacy and blows may be parried only by harder blows, the loss that Germany may have to charge up to her war on commerce, may make the loss she has inflicted upon that commerce seem as unimportant as the shadows cast on the waters by passing clouds.

The subject we are investigating has from a naval standpoint, a twofold interest. Primarily as to the effect the type of submarine activity as employed by Germany is having upon the English military situation, and secondarily as to what might have been accomplished by other forms of submarine activity. The latter is speculative, it is true, but a great deal of the art of war is speculative, particularly to those who have not had experience in

actual war, and speculation based upon reasonable premises must always remain one of the chief guides in warfare.

Prior to the Great War it was in the nature of an open secret that in case of an Anglo-German War the type of naval warfare to be used by Germany was to be one of attrition until England's fleet had been brought to such size that the German fleet could meet it with fair chances of success. Submarines and surface torpedo craft were to be the chief instruments in this campaign of attrition. We know that for the first few months of the war this was the type of naval campaign employed by Germany, and not without a considerable degree of success. In the six and a half months of war prior to the inauguration of Germany's submarine campaign against merchant ships, she sunk in the North Sea at least eight men-of-war by submarine attack, whereas since that time in 22 months she has sunk in the same way, so far as we know, only two light cruisers (the *Falmouth* and *Nottingham,* in a fleet contact) and a few torpedo craft. In the battle off Jutland German submarines seem to have accomplished but little. How could they, when they were seeking easier but less important victims far and wide?

In the meantime many submarines were lost while conducting their attacks on commerce. Thus Germany has allowed her submarine power to be frittered away—to be destroyed in detail, contrary to the very principles of warfare of which generally she is so staunch an advocate.

What Germany might have accomplished by her submarines had they been used solely in a campaign of attrition against the English fleet during the last 22 months, no one can say, but one is very safe in saying that the military results of such a campaign would have exceeded those produced by the submarine attacks on shipping.

It would be most interesting could we know for certain what motives impelled Germany in changing her type of submarine campaign. Was her usually clear military judgment clouded by anger? Did she over-rate the results of her attack on commerce, or the actual accomplishments of her flotillas of submarines? Did she think some hitherto unknown peace-compelling property had been added to commerce destroying by the economic developments of recent years? Or was it merely the historic repetition of the lure of an easy mode of naval warfare? With our present knowl-

edge we cannot answer, but from what we know it seems that Germany committed a grievous military error when she diverted her submarines from attacks on naval vessels to attacks on ships of commerce.

Though possibly not strictly within the scope of our inquiry, it may be of interest to note that friction with neutrals is one of the historic corollaries of war on commerce. It is not difficult for one warring on the commerce of an enemy to convince himself that an occasional attack on a neutral will produce results of benefit to his country, and such attack is so *easy,* and resistance so futile. Of course, such attacks may be of use in specific instances, but the resulting resentment of the neutral, if nothing more, is bound to react to the advantage of his enemy, particularly if that neutral is of importance in the family of nations. Especially in this day the good will of neutrals is an asset of considerable importance to a belligerent, and war on commerce is a very likely way of alienating such good will.

What conclusions, based upon antecedent probability and known present results, are we justified in drawing from our inquiry? So far the results of Germany's submarine campaign against commerce have been just about as might have been expected from the known results of commerce destroying in former wars. It has been conducted on no greater scale comparatively than have the other features of this great war, nor has it inflicted damage relatively greater than has been inflicted by some former campaigns against sea-borne commerce. The submarine itself has not changed the fundamental characteristics of this form of warfare, nor imparted to it any peace-compelling property. England is suffering severe monetary loss through submarine attacks on her merchant fleet, but the military effect of this is small, since it is but a small percentage of the expense of war, it is very largely compensated for by the enhanced value of her remaining ships and it may in large part be charged to the economic future through external loans. The English lines of communication for food and other necessary supplies both to England and from England to her oversea armies, have not been impaired to such a degree as to bring undue pressure on her people at home, or to circumscribe seriously her military activities abroad.

It is not sufficient that the *effort* be made to cut off England's lines of overseas communication, to bring her to bankruptcy, to

inflict suffering upon her people; to be effective these things must actually come to pass, and neither the method, the instrument nor the practice of the present attempt indicates that the great objective will be attained—at least so long as England's fighting fleet bars the way.

NOTE.—Various naval authors have been consulted in preparing the first part of the above, particularly Mahan, Darrieus, Daveluy, Corbett and Thursfield.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

"UNRESTRICTED" COMMERCE DESTROYING

By CAPTAIN LYMAN A. COTTEN, U. S. Navy

That it was highly precarious to discuss war-history in the making was clearly understood when the foregoing essay on Commerce Destroying in War was written in the autumn of 1916, and it was so stated therein. This was emphasized a few months later when Germany launched a campaign of commerce destroying not only on a scale much more ambitious than any former campaign against merchant ships, but also having for its purpose a much more important military objective. Now that this campaign is finished, and the war is over, it may be of interest to consider further the subject of commerce destroying in war with the object of ascertaining as far as may be possible what deductions can reasonably be drawn from the operations of the last two years of the Great War, particularly as to how these deductions refute or confirm the conclusions of the former essay, which was written prior to these operations.

Since Germany's war on commerce was aimed chiefly at England, it will simplify our discussion to consider only those two powers except when otherwise stated.

Germany continued her submarine warfare under the terms of her order of February 4, 1915, until February 1, 1917, when she announced that hencefoth she would forcibly prevent all navigation, including neutral and enemy alike, within certain designated extensive sea areas. Within these areas all ships met were to be sunk without further notice.

It is reasonable to suppose that Germany believed that in taking this step in her war on commerce she was injecting into this form of warfare some peace-compelling quality that up to that time it had failed to show, or that this quality which she believed to be inherent in it was in some way to be enhanced. The German

part of the benefits of such command, which in this case was thought to be a vital part.

The submarine campaign launched on February 1, 1917, was not aimed at England's sea power, through which she exercised command of the sea and denied beneficial use of the sea to Germany; it was aimed at merchant vessels, enemy and neutral, who were engaged in profitable service for England, which, of course, had been made possible by British sea power. It was in the form of an acknowledgment that that sea power itself could not be challenged with reasonable hope of success, and therefore attempt would be made only against part of the benefits of England's command.

Not only did the six notable features of Germany's "unrestricted" submarine warfare tend to facilitate the destruction of merchant vessels engaged in commerce of vital importance to the war-life of her enemy, but the last three were doubtless intended to have another effect on that commerce. The military objective was not the destruction of ships *per se* but the destruction of commerce useful to the enemy. If ships could be made by other means to refrain from taking part in this commerce, the objective was attained so far as these ships were concerned.

The last three features noted violated international law as affecting both enemies and neutrals, and offended against the standards of modern civilization and the most elementary principles of humanity. These features, interpreted through their application by the Germans and in the light of their past conduct afloat and ashore, may best be characterized as constituting a violent form of terrorism. Doubtless the German authorities thought that this terrorism would effectively and permanently prevent a large number of neutral vessels, and possibly some enemy vessels, from taking part in the commerce that it was desired to destroy. In this particular the Germans certainly injected into commerce destroying a new feature, but one that offends against world-standards to such an extent that it is of little naval interest to study it, except as showing how far one may descend when the lust for success overshadows all else, and even honor and every element of decency is not thought too great a price to pay for it. Surely the German Government did not exaggerate when it intimated to our government that it would not neglect *any* means that it thought would bring success.

The naval problem that confronted the German authorities in the autumn of 1916, in so far as it relates to the subject under consideration, was this:

England through her command of the sea was preventing Germany from using the sea for commercial intercourse, thus demonstrating to her as no pre-war academic argument could do one of the values of sea power.

At the same time England was herself enjoying all the benefits of overseas commerce that she was denying to Germany.

Germany could not with reasonable hope of success challenge the sea power of England.

If the benefits of overseas commerce could be taken from England she would be vitally injured, as Germany could deduce from the object lesson of Germany herself.

Germany had certain vessels that could operate against merchant ships with a fair degree of immunity from England's fighting ships, *under certain conditions.*

To solve this problem required:

(a) A large number of submarines.
    This she had, and more were building.

(b) Concentration.
    This she could control.

(c) A reasonable degree of immunity for her submarines.
    This she could only hope to get by using them in an illegal and inhuman war. This she did.

Thus we may say that after all the only new element in Germany's final war on commerce was terrorism. It was not the submarine that made this campaign so dangerous, but the inhuman way in which it was used. It is but a manifestation, so often shown by Germany, that a desired end justifies *any* means. Working under this premise it must be admitted that the "unrestricted" submarine campaign of Germany gave promise of solving satisfactorily the problem under consideration, *looking at that problem solely as it existed at that time, and not taking into consideration the changes that would be made in the problem by reason of the very agency that attempted its solution.*

In this respect Germany's decision may reasonably be compared with her decision to invade France by way of Belgium. As the problem existed *before a solution was undertaken,* there is little

doubt but that the easiest way lay through Belgium. But the very attempt changed conditions by bringing Belgium into the war against Germany, by precipitating England's decision to enter the war, and by alienating very largely the good will of the neutral world. All of these changes, of course, increased the difficulties of the German problem as it had existed prior to the invasion of Belgium.

In attempting to solve to her own satisfaction the problem of England's overseas commerce by injecting the element of frightfulness (illegal and inhuman practices) into her campaign, Germany not only set in motion counter-influences to make that problem more difficult, but also, as we shall see, brought in new factors in other fields of war activity that worked to her very serious detriment in her effort to win the war.

Having looked into the nature of the German problem and having seen the means and method by which she attempted to solve it, we may now consider the results, which in war is the final criterion.

The mere announcement that Germany was going to indulge unrestrictedly in her well-known capacity for frightfulness on the sea, produced certain results favorable to the attainment of her objective. *Neutral* sea-borne trade in and adjacent to the sea areas surrounding her enemies was disorganized, and, for a time, very nearly stopped entirely. Merchant vessels of her enemies, however, continued to carry on as before, recognizing that their duty was too vital to the Allies to be interfered with by anything less than physical stoppage, and taking the increased dangers and frightfulness as unavoidable parts of their burden of war.

The effect of the practical cessation of neutral overseas commerce in European waters was serious on the Allied cause, for Allied merchant vessels had been materially reduced during the first two years of war. Had this cessation been permanent it might have had a deciding influence on the outcome of the war, but it was only temporary, as might have been foreseen. In war attempted commercial suppression automatically sets in motion counter-agencies which tend to off-set the suppressive measure. Thus, a blockade according to its degree of effectiveness by increasing the reward for running the blockade, automatically induces the more frequent attempt to do so. The threat of capture is not effective itself, even though capture may be attended by

dire results; the chances of success must be reduced below the point of possible adequate reward for success. In a revolution-infested country, though the penalty of capture at "gun running" may be death, still it will be undertaken so long as the chances of success are such as a human being will accept and adequate rewards of success are forthcoming. To be effective a suppressive measure must be positively so, and not dependent upon collateral influences.

German frightfulness in her "unrestricted" submarine warfare, being at once recognized as a deterrent upon neutral commerce useful to the Allies, caused a further rise in freight rates and increased liberality in government insurance. At the same time such additional safeguards as the Allied navies could give were given, and from the results of voyages actually made into the "barred" zones it was seen that the chances of success were not prohibitive when the rewards for success were considered. Under these conditions neutral commerce was soon induced to resume its war trade. Thus frightfulness as a deterrent factor was largely counterbalanced by economic adjustments, these adjustments, of course, being borne by the Allies in the way of higher freight rates, increased insurance losses, and curtailed consumption.

This still left the problem of intensified destruction of merchant ships, both belligerent and neutral, to be countered. There is no question but that this problem was for some time a very serious one. During the first three months of "unrestricted" submarine warfare over two million tons of shipping were sunk, and the curve of destruction was still ascending. In the third month alone approximately 875,000 tons were sunk. The attainment of Germany's objective was only a matter of arithmetical calculation if she could keep up her attained rate of sinkings and if no new construction was completed to replace the ships sunk.

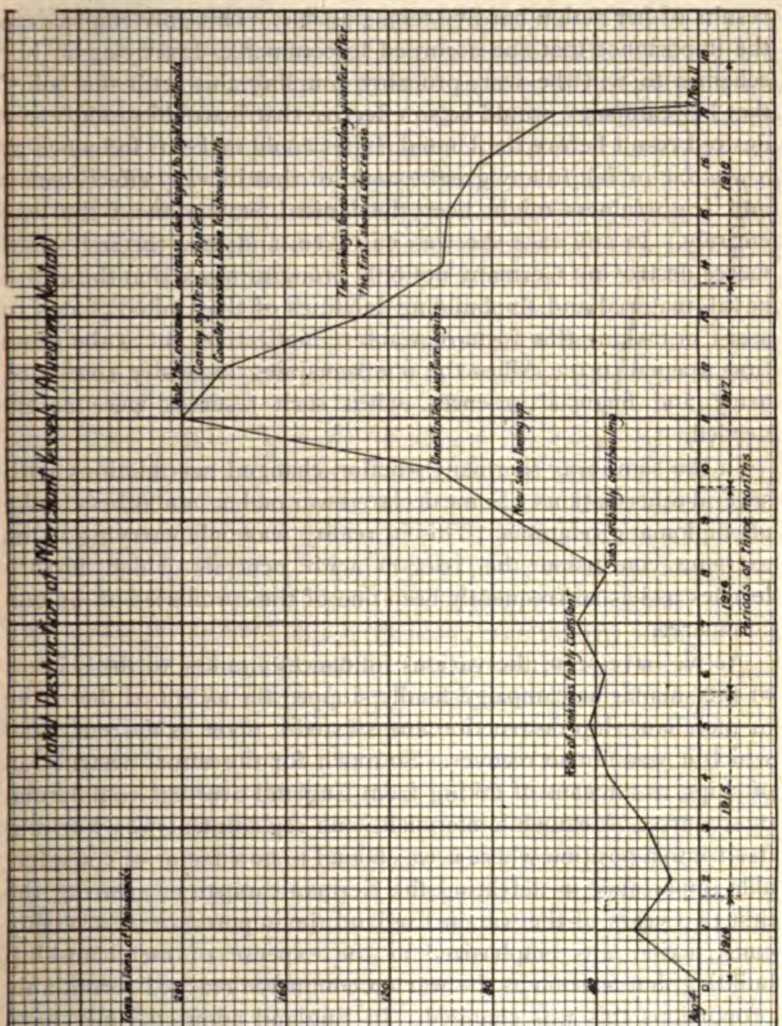
In waging war it may be accepted as a truism that any new agency or method employed will cause the development of counter measures, and to attain its object a new thing employed must command success before the counter measures become effective. This the "unrestricted" submarine warfare did not do, though it came near enough to it to make one seriously wonder if frightfulness was not going to produce material dividends of large proportions, whatever might be its moral quality.

That the illegal and inhuman way in which the submarine warfare was conducted added enormously to its effectiveness there can be no question. It was, no doubt, adopted primarily for that reason, its deterring effect on neutrals probably always being recognized as secondary. The sinkings by submarines began to increase quite markedly several months before the beginning of the "unrestricted" campaign. This was in all likelihood due to the increased number of submarines being made ready for the new campaign. Any way the first three months of "unrestricted" warfare produced an increase in sinkings over the preceding quarter year of almost exactly 100 per cent, though the sinkings for the former quarter were themselves much in excess of those of any other like period prior to that time.

It, of course, takes time for counter measures to develop, and this is particularly true as to measures to counter illegal and inhuman practices that right-minded men considered as beyond the pale under modern standards. Apparently the counter measures began to be increasingly effective after the first three months. The curve below shows the total tonnage sunk by quarter years for the entire war, that the effects of "frightfulness" and counter measures may be seen at a glance.

The counter measures adopted are so generally known that they need no extensive comment, but it is interesting to note that they really involved no new principles, though new devices were employed. Some of the counter measures were defensive and some offensive. They included, in general terms, increased employment of anti-submarine vessels, anchored mines, and air patrols, the adoption of the convoy system, and the development of special weapons of offence and of submarine detection devices.

In the meantime the method of warring upon commerce adopted by Germany had produced one very important and concrete result, not only vastly increasing her difficulty in pressing this warfare to a successful conclusion, but also adding materially to the burden of her efforts in other fields. On April 6, 1917, the United States declared war on Germany as a direct consequence of her ruthless submarine warfare. However probable it may be that the United States would have entered the war against Germany at some later date in any case, it can hardly be denied that she was actually brought in by Germany's action based on the


Total Destruction of Merchant Vessels (Allied and Neutral)
Rate of sinkings fairly constant
Unrestricted warfare begins
Convoy system adopted
1914
1915
1916
1917
1918
Periods of three months

fallacious belief that she could win the war by commerce destroying as it was to be practiced by her.

That Germany could not have foreseen this as one of the possible results of her action hardly seems possible. This only emphasizes the importance that she accorded to commerce destroying in her schemes to win the war, probably coupling this with the belief that her campaign would be so effective that it would produce the desired result before the United States could make its influence as a war factor felt to any great extent, or that its very effectiveness and frightfulness might keep the United States out of the war entirely. In any case she was mistaken, and thus through commerce destroying Germany not only brought into action the entire naval, material and shipbuilding facilities of the United States to assist in making this form of warfare ineffective, but at the same time opened to the Allies the one remaining extensive source of army and financial reserves, when such reserves were sorely needed.

In the same way Germany's action changed her relations with several other nations. Some declared war on her, and others broke off diplomatic relations. This in reality was only carrying to its extreme conclusion the friction with neutrals which history teaches us has so frequently been one of the corollaries of war on commerce.

As we have seen, the various influences counter to the success of the submarine campaign finally stopped the ascent of the curve of merchant ship destruction and started it upon its descent from which it was not to recover. So much for the actual destruction of ships, as a means of taking from England overseas commercial intercourse. Meanwhile merchant-ship replacement was working itself into a position where it was bound to be a factor of considerable importance in defeating the German campaign. During the first two years of the war in England the importance of war-ship construction was emphasized at the expense of merchant-ship building, but as soon as the war on commerce reached formidable proportions this was changed. In England additional merchant ships were laid down, and in the United States an enormous building program was started. It is one of the weaknesses of war against an industrial element that industrial resources can be brought to its aid with great facility and these can act far from the fields of actual combat. When through the offensive and defensive

measures adopted and the new construction undertaken the curve of destruction dipped under the curve of replacement, war on commerce as a means of bringing victory to Germany could be definitely characterized as having failed.

It is interesting to note that even when the submarine warfare was attaining its greatest degree of success, and despite the element of terrorism injected into it, the overseas commerce of the Allies continued to function without ceasing for as much as one day. In the meantime, of course, the sea was not made one whit safer for German sea commerce by her campaign against the commerce of her enemies, and, just as it had been from the beginning of the war, German merchant ships remained off the high seas. This indeed is one of the inherent weaknesses of direct war on commerce. It is an attempt to deny to an enemy the use of the sea for a particular purpose but not for other purposes, without in any way adding to the facility with which it may be used by one's own vessels. This was doubtless recognized by Germany before she decided to undertake this form of warfare in the way she did, but, since she could not hope to challenge successfully England's command of the sea she was willing to attempt something less. To deprive England of even a part of the benefits to her of command of the sea was recognized as important enough to warrant the attempt on a large scale, even though other powers might thereby be brought into the war as enemies, and even though practices had to be adopted that would make the German Navy a stench in the nostrils of civilization.

The most interesting thing that we note from Germany's vast campaign of commerce destroying is that despite the scale upon which it was conducted, notwithstanding that it was conducted generally in accordance with the sound military principle of concentration and even though it employed the added element of frightfulness, it was none the less associated with defeat, just as all former campaigns of direct commerce destroying have been. In this case it is not only interesting, but highly satisfactory that such was the case.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

DESIGN AND CONSTRUCTION OF THE *NC* FLYING BOATS

By COMMANDER G. C. WESTERVELT, C. C., U. S. Navy

In June, 1917, two months after the entry of the United States into the World War, no definite air policy or program had been adopted by this country. This condition was due to the lack of any conclusive information regarding the work of the Allied Governments along these lines, and to varied and contradictory recommendations which had been received from the War Departments and the Admiralties of Great Britain and France as to the types of planes which should be adopted by this country. To remedy this condition an informal joint Army and Navy Board was appointed to proceed to Europe and to make a study of air matters among the principal governments engaged in the war against Germany, and to recommend the steps to be taken by our government in building up its own air services and in carrying out a definite air policy.

The personnel of this committee was Major R. C. Bolling, Captain V. C. Clark, Captain E. S. Gorrell, Captain Howard Marmon and Captain Hughes representing the army, and Lieutenant W. G. Child and the writer representing the navy. In accordance with instructions to the committee, they proceeded to Europe, arriving in London the latter part of June. At this time, the naval activities of the U. S. Government were directed mainly against the submarines. The center of naval activities was the American Embassy in London, and by this time the naval officers had become keenly aware of the grave menace of the German submarines. At the embassy all discussions centered around this subject, and it was evident that fuller methods of combating the submarine must be provided and provided very

quickly. Accordingly, we began a particular and detailed study of the types of aircraft for use against the submarine menace. This study was carried on in England, in France, and in Italy, and, as a result of this study, it was concluded that the quickest way for the navy to obtain results in the air would be with kite balloons, for observation purposes, anchored to a destroyer or some other type of patrol vessel, and with seaplanes of the flying boat type, as differentiated from the hydroaeroplane, for patrol purposes and for the bombing of submarines.

At this time, the largest flying boat in use for patrol work was the *H-12*, a craft equipped with two Rolls-Royce motors, with a lifting capacity of approximately 9000 lbs., and a cruising radius of slightly over 500 miles. This type of boat had proved successful in patrol work, except for its limited cruising radius. Because of the fact that the regions in which submarines were active were often a considerable distance from the naval air bases, the entire time available for patrol was often used in flying to and from a base. It was very desirable that larger craft should be provided, craft which could not only carry a heavy load of bombs, but which also had sufficient radius of flight for the trip from the naval bases to the patrol regions and return.

The writer returned to this country on September 1, 1917, and on September 2 reported the results of the investigations to Rear Admiral D. W. Taylor, the Chief of the Bureau of Construction and Repair. Admiral Taylor had been much interested in the work of the larger flying boats, and his parting injunction to the writer before his departure for Europe was to examine carefully the work being done along the line of flying craft much larger even than any then in use. When the report with its recommendations had been presented to Admiral Taylor, he immediately went far beyond any recommendations which had been made, and ordered the design of a flying boat able to fly itself, if possible, across the ocean. This would mean the capacity to proceed before daylight from a seaplane base to the patrol area, to spend the day in patrol work or in convoy, and to return to its base after dark. In addition to this, it must be able to carry several bombs of a size sufficient to increase very materially over the possibilities of that day the danger zone in the bombing of submarines.

All the information made available regarding the design and construction of flying boats of great size indicated the enormous

difficulty of such a project. The trend of opinion of the European air ministries was against such large sizes, and, as far as the methods of construction and the motor powers available at that time were concerned, the limit of size had been practically reached. On the presentation of these facts to Admiral Taylor, and the pointing out to him of the possibility of failure of such a project, he declined absolutely to be interested in this phase of the problem, and in his characteristic manner closed the discussion he was having with Naval Constructor Hunsaker, head of the Construction and Repair Aeronautical Section, and the writer, with instructions to "get busy and produce results."

This was the inception of the design of the *NC* type of flying boats. After a conference between Naval Constructor Hunsaker and the writer, it was decided to call upon Mr. Glenn Curtiss, at that time the American most experienced in the design and construction of seaplanes, for his suggestions as to the type of seaplane which might best fulfil the requirements. In obedience to a request from Admiral Taylor, Mr. Curtiss came to Washington, and, in a conference between the naval officers above referred to and himself, it was decided to give consideration to the possibilities of a seaplane capable of sustained flight from Newfoundland to Ireland, if possible, or at least capable of flight from Newfoundland to the Azores. Certain definite conclusions reached by the bureau regarding the probable type of such a seaplane were given Mr. Curtiss for his examination.

Within a few days after this conference, Mr. Curtiss returned to Washington with preliminary plans for two types of flying boats, embodying in their general characteristics the conclusions of the bureau—one a five motor 1700 horsepower machine, and the other a three motor 1000 horsepower machine. Both were biplanes, similar in design, and differing only in size, the size being dependent upon the available horsepower. The hulls of these machines differed greatly from the conventional design. They were much shorter than the conventional boat hull, were shaped more like the pontoon of a seaplane, and with the intention that the tail surfaces instead of being supported by the hull would be carried by a system of outriggers in part from the upper wing beams, and in part from the stern of the hull. These suggestions covered rough sketches only of the proposed machines, together with certain estimates based on extensive experience as to weights

and sizes. Admiral Taylor was in favor of the larger boat. The writer, however, due to his experience in airplane construction, his familiarity with the limitations in manufacturing facilities, and because of the small experience of our designers, and of uncertainties regarding the availability of suitable engines, argued in favor of the smaller craft. The final decision was to not attempt the construction of the larger size of 1700 horsepower but to stick to a smaller one of approximately 1000 horsepower.

In taking up the design of such a seaplane, it was very evident that radical changes in the method of design must be followed. With the methods of design at the time almost generally employed, the limits of size had been practically reached. The largest machine at that time in use was the Handley-Page night bomber. In the design of this airplane new and advanced methods had been employed, and to its study much consideration was given. This machine had a total lifting capacity of 11,000 lbs. and was equipped with two 275-horsepower Rolls-Royce motors. The dead weight was approximately 6600 lbs., and the allowable weight for oil, gasoline, cooling water, crew and miscellaneous supplies, which grouped together are called by the name of "useful load," was 4400 lbs. This made the value of the useful load 40 per cent of the gross load, which was the maximum percentage which had been obtained in any large machine. Naval Constructor Hunsaker in estimates which had been made of various planes of an average lifting capacity of 2500 lbs. had found that the percentage useful load was from 30 to 32 per cent. The proposed design for the 1000-horsepower flying boat called for a total load of approximately 25,000 lbs. In comparing this machine with the Handley-Page night bomber, it was apparent that the design of the Handley-Page would have to be improved upon and the percentage of the useful load made at least as high if this design was to be considered successful. One possibility of improvement of the design was in the use of the Liberty motor which was at that time undergoing its first tests, and which gave promise of being lighter for its power that any other motor then in use.

It has been found in the design and construction of large airplanes and seaplanes that the unescapable dead weights, such as engines, propellers, radiators, gasoline and oil tanks, crew, etc. which must be allowed for, require, in a completed plane which will carry them successfully, a total weight of, roughly, from three to

four times the sum of these dead weights. If in any manner, such, for example, as by a reduction of the weight per horsepower of the motor, 100 lbs. can be saved in the weight of any of these parts, there can be a reduction in the total flying weight of the machine of from 300 to 400 lbs. or else a considerable increase in the weight of gasoline which can be carried. There were also possibilities of reduction in weight of structural elements, such as wing beams, ribs, wing struts, compression struts, fittings, etc. If by any method of design it were possible to reduce the weights of these parts without reducing their strength, there would again be a gain in the fuel carrying capacity of the machine over that possible with methods of construction at that time in use.

The points outlined above give some idea of the problem of design which it would have been necessary for the Bureau of Construction and Repair to handle in the preparation of plans for this boat. Because of the insufficient technical force at the bureau, and the difficulty in increasing this force, it was decided that the best method of procedure would be to transfer the physical work of the design of this machine to the Curtiss Aeroplane and Motor Corporation at Buffalo. The Curtiss Aeroplane and Motor Corporation was the only aeronautical manufacturing company which had a well organized design force in any way capable of handling this problem. On the transfer of this design to the Curtiss organization, it was intended that the navy would exercise close control over the design, and that the Curtiss organization should work out all details under navy supervision.

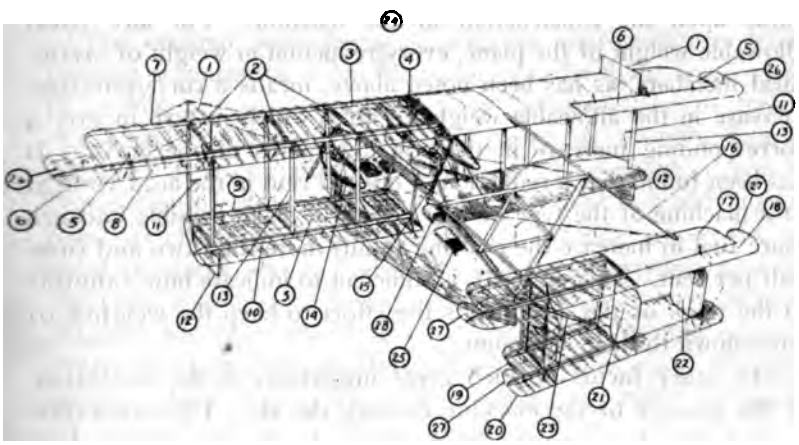
When plans for the design had been carried this far, it became necessary for Admiral Taylor to obtain the cooperation of the other bureaus which would be concerned in the construction of such a craft, and to obtain the approval of the Secretary of the Navy. The Division of Operations and the Bureau of Steam Engineering agreed to the carrying out of these plans, and the entire proposition was then submitted to the Secretary of the Navy. The secretary approved the proposal which had been made, and it was then possible to proceed upon the definite work of design. Accordingly, a contract was made with the Curtiss Aeroplane and Motor Corporation on the basis of cost plus a fixed profit on the determined cost. Such a contract was necessary because no design similar in nature to this had even been attempted, and there

were no figures available which could give even an approximate estimate of the cost of such a design. The contract as arranged provided that all labor and material should be charged directly to the contract. To this charge 100 per cent would be added to cover intangible and indirect expenses which could not be definitely estimated; and, to the sum of these two amounts, 10 per cent was to be added for profit. This proposed contract was satisfactory to both the navy and the Curtiss Aeroplane and Motor Corporation, and work was started upon the design early in October, 1917. The design work was later transferred to the Curtiss Engineering Corporation at Garden City, Long Island, where it was completed in January, 1918.

At this time it became necessary to choose a name for this type of flying boat. Inasmuch as the design work was under the supervision of the navy but was being carried out by the Curtiss organization, it was decided that the name of the type would be the *NC-1*, *N* standing for navy and *C* for Curtiss, and the *1* representing the first boat designed under this arrangement between the navy and the Curtiss Company. It was intended calling specific boats of this type *NC-1*, No. 1, *NC-1*, No. 2, etc., but as this has proven awkward in use the type is now known as the *NC* type, and the specific boats as the *NC-1*, *NC-2*, etc.

The method usually followed until a year or two ago in the production of new types of flying boats, and for new types of airplanes in general, had been to make sketches of the proposed type of plane and of some of the more important elements and details, estimate the probable weight, and then to proceed immediately upon the construction of parts. If the completed machine did not give satisfactory operating characteristics, certain parts would be changed and it would be tried again. This method would be continued until the design proved to be entirely unsuited for practical use or some satisfactory compromise was reached. With such an unscientific method of design it is exceedingly difficult to determine why a plane fails to come up to the estimated performance. If the weights are excessive, it is difficult, or even impossible, to determine wherein the excess lies, or how to change the construction to make a reduction. If the speed of the machine fails to come up to expectations, it is practically impossible to determine what changes can be made.

In the design discussed, due to the great increase in size over any successful boat previously constructed, and to the necessity of increasing the percentage of useful load above any which had been reached in flying boats, the adoption of the method of procedure as outlined above would have made failure certain. It was determined to have every detail designed carefully, according to



DIAGRAMMATIC SKETCH OF "NC-4."

1. Non-skid Fin.
2. Compression Struts.
3. Wing Ribs.
4. Gravity Tank.
5. Aileron Horn.
6. Aileron.
7. Forward Beam—Upper Panel.
8. Rear Beam—Upper Panel.
9. Forward Beam—Lower Panel.
10. Rear Beam—Lower Panel.
11. King Post Brace—Outer Struts.
12. Wing Tip Pontoon.
13. Wing Struts.
14. Outer Nacelle.
15. Pusher Propeller.
16. Outrigger.
17. Upper Horizontal Stabilizer.
18. Upper Elevator.
19. Lower Horizontal Stabilizer.
20. Lower Elevator.
21. Balanced Rudder.
22. Vertical Stabilizer.
23. Tail Boom.
24. Pilots' Seats.
25. After Hatchway.
26. Balancing Section—Ailerons.
27. Balancing Section—Elevators.
28. Aluminum Shield under Pusher Propeller.

the best engineering practice, and to have the design practically completed before any construction work was commenced. It was only in this way that it would be possible to arrive at a design which would give a practical certainty of a flying boat coming up to the requirements laid down by Admiral Taylor, or which failing in this would show definitely and exactly to what failure was due.

In the design of any type of airplane two factors are of major importance. One of these factors is weight. The relation between weight, effective lifting surface, and the speed of flight, may be expressed by means of an equation, $L=K_y AV^2$, where L represents the total weight in pounds, A is the total effective area of all supporting surfaces expressed in square feet, V is the speed expressed in miles per hour, and K_y is a constant depending for its value upon the construction of the machine. For any total allowable weight of the plane, every reduction in weight of structural members, as has been noted above, means a corresponding increase in the allowable weight of fuel, which in turn means a corresponding increase in the cruising radius of the craft. It has been found that a reduction of one per cent in the dead weight of a machine of the type of the *NC-1* will make possible enough more fuel to increase the cruising radius more than two and one-half per cent. This, in itself, is sufficient to indicate how valuable in the work of the designer is the effort to keep the weights of parts down to their minimum.

The other factor of such great importance is the resistance to the passage of the machine through the air. This resistance is made up of two parts, the resistance of the wing panels and control surfaces, and the resistance of other parts, such as wires and cables, wing struts, nacelles, boat hulls, etc. The resistance of a wing panel has a certain very definite value for each type of wing surface, and has been very accurately determined for all the different types of wing sections. The other resistances, which are grouped together under the general term of "parasite" resistance, must be calculated for each separate part, taking into account the size and length of the part, and its position with respect to the direction of motion. From tests which have been made, the values of coefficients for use in calculating these resistances have been very accurately determined, and the total resistance or "drag," which is the term used to represent the combination of wing panels and parasite resistances, may be calculated. The resistance for any individual part may be expressed by means of an equation similar to the one used above for the total lift or weight. This equation may be written $D=K_x AV^2$, where D represents resistance expressed in pounds, V is the velocity of motion in miles per hour, A represents an effective area of all parts producing the resistance and K_x is the co-efficient referred to above. The total drag

is the summation of these resistances, plus the wing panel resistances. The horsepower required to move the plane through the air at a given speed is then determined from the expression: Horsepower $= \frac{\text{Drag} \times \text{velocity}}{375 \times \text{eff.}}$; where drag is the total drag in pounds as calculated above, velocity is expressed in miles per hour and efficiency is the propeller efficiency, which in turn depends upon the velocity and the revolutions per minute of the propeller.

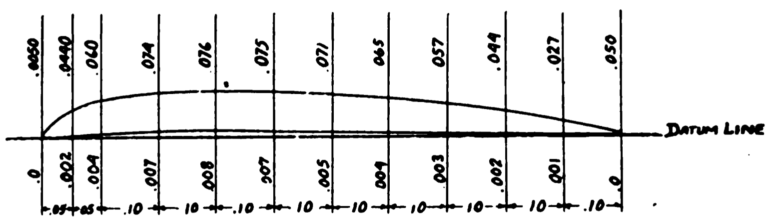
The original plans discussed with the representatives of the Curtiss organization called for the design of a flying boat capable, if possible, of sustained flight from Newfoundland to Ireland. As soon as the design had progressed far enough, accurate calculations of weights and resistances were made. Upon the completion of these calculations, it was found that although the total weight came within the specified limits of 25,000 lbs., the total resistance was so high that, with the horsepower available, the speed would be cut down to such a low value that the estimated cruising radius instead of being the 2000 miles required for going from Newfoundland to Ireland, would be not more than 1300 miles. There seemed to be no possible way by which the amount of this resistance could be reduced and, because of this fact, the design of a flying boat capable of flying from Newfoundland to Ireland had to be abandoned as impracticable, temporarily at least. The design was now taken up on the basis of a total weight of 22,000 lbs. and a cruising radius of 1300 miles.

It would have been possible at this time to take up in detail calculations for a five-motored flying boat, as previously suggested by Mr. Curtiss. Difficulties which had been met with in the design of the three-motored craft had shown, however, that the original decision regarding size and horsepower had been wisely made and that it was better to continue the work with the three-motored type of craft, even though its cruising radius were limited to 1300 miles.

It was necessary to carry on a considerable number of very complete investigations to determine the sizes and shapes of parts to be used in the construction and the materials of which these parts should be made. These investigations had to do with the choice of wing beams, wing struts, wing ribs, compression struts, metal fittings, outriggers for the tail support, and various other parts to be used in the construction of the hull and tail surfaces.

Before a choice of materials to be used in the manufacture of the parts of the wing panels could be made, it was necessary to determine the shape of the wing panel section to be used in the construction. After consideration of various sections, it was decided to make use of the wing section known as the R. A. F. 6, a section designed and used extensively by the Royal Aircraft Factory of Great Britain. This section has a good lift factor, and the lift-drag ratio, which represents the efficiency of the section, is high. Another factor which determined the choice of this section was the depth of the section itself. Due to the large span of the proposed seaplane, the wing beams must, of necessity, be of considerable depth to give the necessary strength, and, inasmuch as

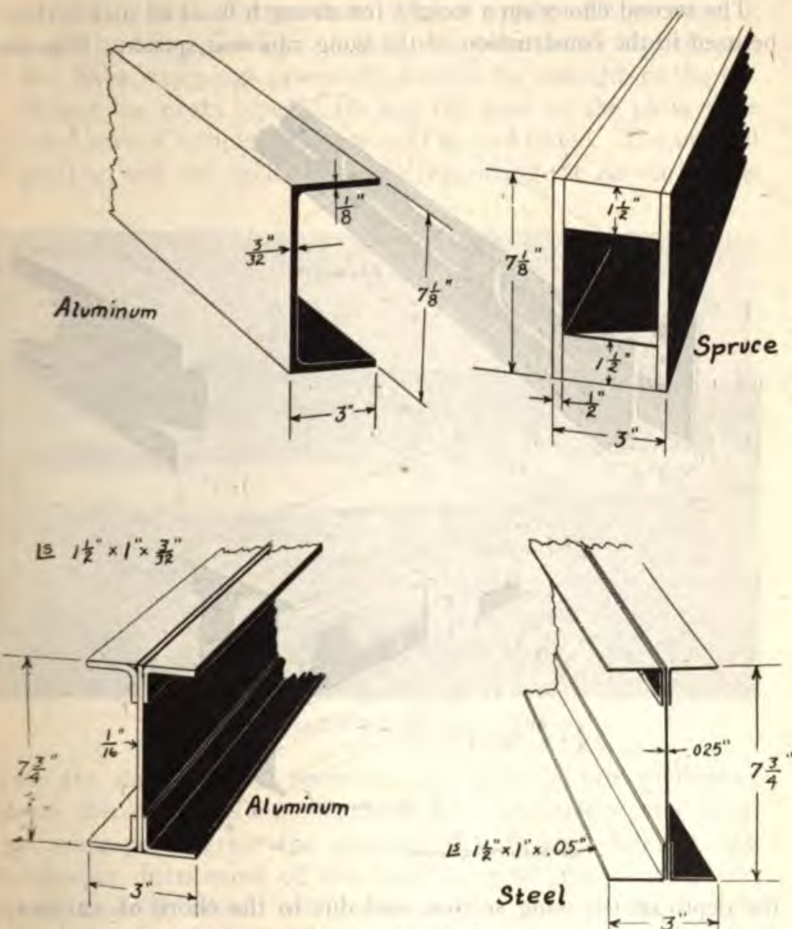
RAF-6 AIRFOIL SECTION



the beams are enclosed within the wing structure, it was necessary to have a wing structure which in itself had the requisite depth.

In the choice of the wing beams to be used, beams built of steel, aluminum and spruce, of various cross sections, were investigated. The more important types of these beams are shown in the accompanying sketches. The total depth of the beam was to be approximately 10 inches; the total length of the beam in the upper outer panels was to be approximately 45 feet; and it was required to carry a load of 190 lbs. per running foot. As the final choice, to meet these requirements, a spruce beam built up in the form of a box was selected as the one which would be most satisfactory in construction and in operation. This choice was based upon weight for a given strength, upon availability and dependability of material to be used in construction, upon ease of construction, and upon the stiffness of the beam for the required depth.

In the choice of wing ribs, ribs built up of aluminum, of steel and of spruce were considered. Based upon weight alone, the choice would lie with the aluminum rib. Weight, however, is

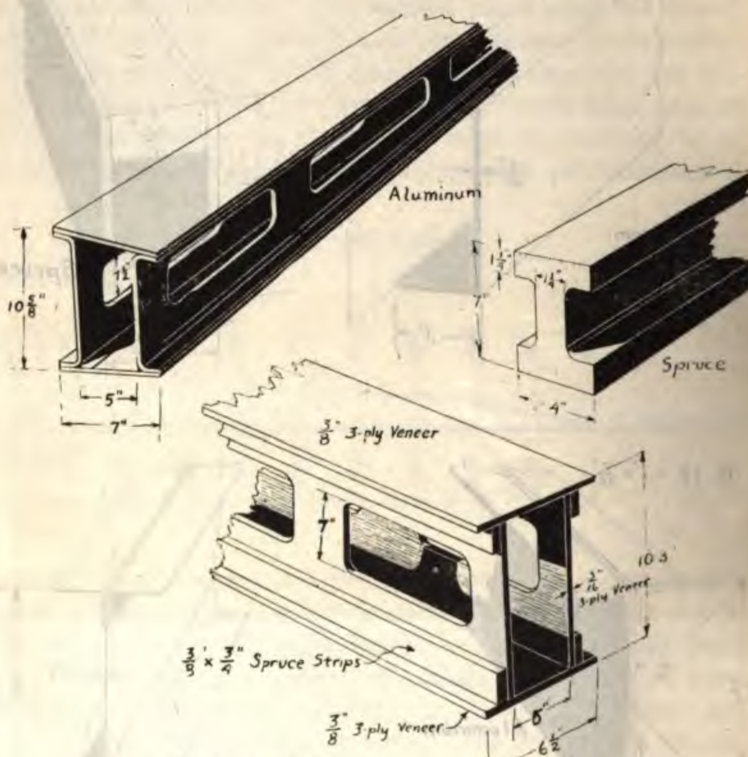


PROPOSED WING BEAMS.

not the only factor which must be considered in the choice of the wing rib to be used. With aluminum, there would be danger of deterioration due to the effect of moisture; there would be great difficulty in making satisfactory connection of the several parts of the rib structure; and there would be difficulty in obtaining alumi-

num which could be depended upon as uniform in structure and in strength. For these reasons, the use of aluminum for construction of wing ribs, as well as for construction of other strength parts of the machine, was decided against.

The second choice on a weight for strength basis of material to be used in the construction of the wing ribs was spruce. Due to



PROPOSED WING BEAMS.

the depth of the wing section, and due to the chord of 12 feet, the best construction seemed to be one in which the rib was built up of spruce capstrips, used to form the upper and lower surfaces, joined together by means of small vertical and diagonal spruce members arranged in the form of a truss construction. This construction is very similar to that of the Handley-Page rib, which it had been the writer's good fortune to be able to examine during the trip to Europe which has been mentioned previously.

In this rib great importance attaches to one of the constructional features. At all joints between the vertical and diagonal truss members and the capstrips, a linen wrapping is used. It is fastened to the spruce members by means of Keystone glue; causes them all to act in unison; and produces a most appreciable increase in strength and in reliability. Actual tests have shown that the use of the linen wrappings practically doubles the strength of the rib.

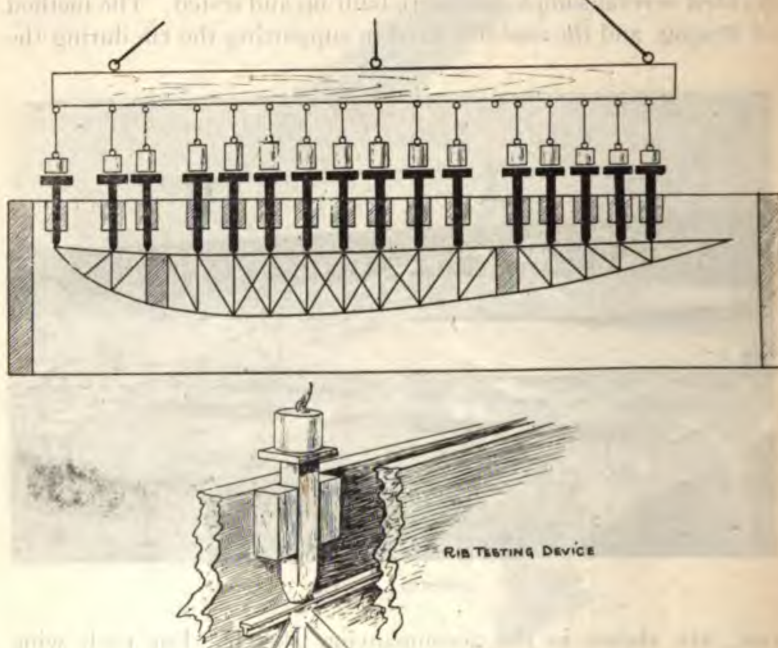
Before the exact type of rib and the sizes of the parts were decided several sample ribs were built up and tested. The method of testing, and the machine used in supporting the rib during the

"NC-4" ASSEMBLY OF RIB TO BEAM.

test, are shown in the accompanying sketch. For each wing curve there is a definite distribution of load above and below the wing panel from the leading edge to the trailing edge. By proper distribution of this load along the rib, weights may be determined which will represent the loads acting at the joints of the truss members and these weights may be so calculated as to give these members their normal loading or any desired excess loading. In the tests made, as in the design of all parts of the machine, except wires, it was assumed that a factor of safety of four would be required.

In the design of the compression struts, it was assumed that these struts would have to carry a total flying load equal to approximately

one-third of the total weight of the machine, or, in round numbers, 7000 lbs. In the investigations made to determine the most desirable compression strut, it was found that aluminum with a circular section was the lightest for a given strength, but because of the reasons stated above, the aluminum was not chosen. The next most desirable strut was a spruce strut of a circular cross section, tapering in each direction from the center towards the ends.

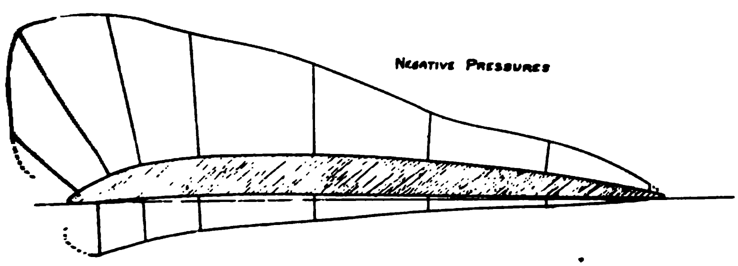


Because, however, of the difficulty of building such struts, it was decided that the one which would be most satisfactory was a spruce strut of a square cross section, built to taper from the center toward each end. Special pin jointed metal fittings were attached to the ends of these struts, and these fittings attached to fittings through the wing beams at the neutral axes.

In the investigation of the shapes and materials to be used in the construction of the wing struts, it was found that steel struts of circular cross section, suitably streamlined, would be very

light. The main disadvantage of these struts was in the extreme thinness of the metal to be used in their construction, if the weight for a given strength was to be kept below that of the spruce struts. This also was true of aluminum struts. Because of these facts it was decided that the most satisfactory struts would be routed spruce struts for the engine section panels, and, for the other panels, spruce struts built up in a box form with the sides curved to conform to a streamlined section, these built up struts to be covered with a micarta covering of streamline form.

To decrease the weights of the struts, it was decided to tie them together at their middle points, across the entire length of the wing panels, parallel to both the front and the rear beams.



PRESSURE DISTRIBUTION ON RAF-6 AT 6° ANGLE OF INCIDENCE

By so bracing the struts at the center points, the unsupported length is reduced to one-half the original length, and it is possible to reduce the width of the strut in approximately the same ratio. This is similar to the construction used in the Caproni biplane. This reduction in width not only reduces the weight of the strut but also reduces the head resistance, and in that way gives double advantage in the construction and in the operation of the plane. To make possible the bracing of these struts across the entire length of the wing panel, it is necessary to reinforce the outside struts to prevent them from bending. This reinforcing is accomplished by means of a kingpost at the center, guyed by bracing wires running to the upper and lower ends of these struts.

Among the parts of the airplane structure requiring the greatest amount of study are the metal fittings used in fastening the

During flight the stresses in the various parts of the wing panel structure are transmitted along the wing panels to the hull by means of the flying wires. During combat it is very possible for one or more of these flying wires to be cut by gun fire. To prevent, as far as practicable, the destruction of the machine due to the cutting of any one of these wires, the design called for these stresses to be carried by three wires in parallel instead of a single one. In later designs, when the need for war purposes had passed,

WING HINGE ASSEMBLY, "NC-1."

this was changed, and the load was carried by two wires in parallel instead of by three. By this change considerable weight and much resistance were removed. It was planned in the original design to have the landing wires, which carry the stresses due to the weight of the wing panels when the machine is landing or at rest, made up of two wires in parallel, but when the flying wires were reduced to two, the landing wires were reduced to a single wire. These landing and flying wires are made of a non-flexible steel cable varying in size from $\frac{3}{8}$ inch to $\frac{1}{8}$ inch in diameter. To reduce the resistance of these wires to a minimum, those in the

wing truss construction are streamlined. For the double wires a routed spruce streamlining is used, and for the single wires a special one of rubber.

In the design of the hull, certain requirements must be met. These requirements may be briefly discussed as follows: The hull must have sufficient buoyancy to support the weight of the craft when on the water. The usual requirement in hull construction is that there shall be a reserve buoyancy of 500 per cent. The hull must have enough stability to keep the wing panels, propellers, and tail surfaces well clear of the water, and must provide reserve stability for possible operation in strong wind or in a rough sea. As the position of the plane changes, the position of the center of buoyancy must change quickly enough to provide this stability, and to bring the machine back to normal. The hull must be of such a design as to steer readily, especially at moderate speeds, on the water. The bow of the hull must be so built as to prevent nosing under at high speed in rough water or in a bad landing. It should also be so designed as to prevent the throwing of spray during taxiing or planing. This throwing of spray may be prevented to a large extent by the use of thin strips known as spray strips along the sides of the bow.

The shape of the bottom of the hull is of great importance in the operation of the machine. It has been found that a wide bottom planes very quickly. A flat bottom planes quickly, but is unstable, and is likely to cause fore and aft rocking of the machine during planing, which is known as "porpoising." The V-bottom eases entrance and getaway and prevents porpoising, but is very likely to throw large quantities of spray. A concave V-bottom has the same advantage as the V-bottom but is difficult to handle, especially in making a skidding landing. Considering all points, the V-bottom is the most satisfactory in its actual use.

To facilitate the lifting of the hull from the water, the hull bottom is built with a portion which has a sharp change in direction at a position a short distance aft of the center of gravity. This portion is known as the step. It is well known that water in motion tends to follow closely any curved surface submerged in it, but will throw itself completely away from a surface in which there is an abrupt change of direction. This fact is made use of in the design of the step and in the design of the hull bottom

aft of the step. The portion of the bottom aft of the step is almost flat and slopes upward at an angle of approximately 3° to the deck. During the time of planing, the water from the step is thrown clear of the after portion of the hull, thus preventing much of the suction which might arise if the water followed more closely the lines of the hull. To aid in preventing this suction, breather tubes, extending from the hull deck downward through the bottom at a point just aft of the step are very commonly used. For the *NC* hull, however, it was decided that these breather tubes were not necessary.

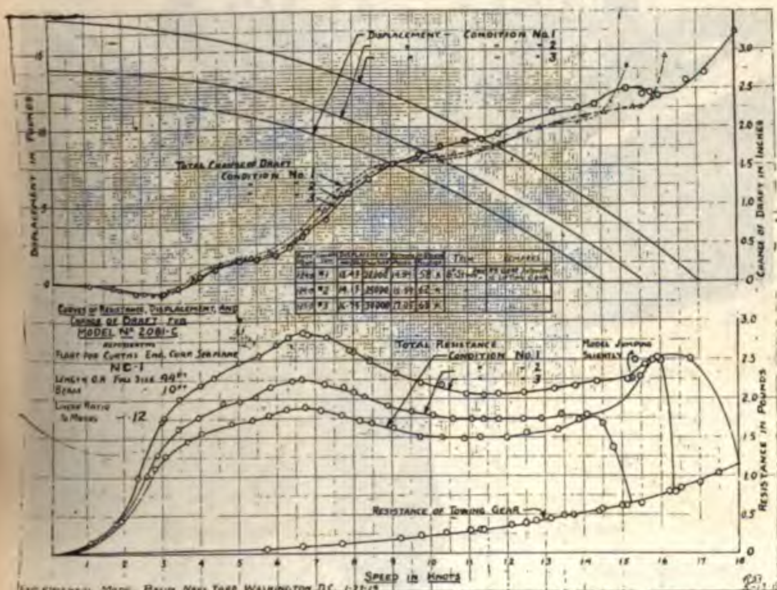
"NC-1" HULL, SIDE VIEW.

The bottom should be so designed that the hull does not plane too rapidly. If, due to too large a planing surface, planing is reached at too low a speed, the machine, when operating on rough water, may be thrown from the water before flying speed has been attained, with a consequent heavy pounding of the hull. The design should be such that the maximum planing speed is always above the minimum air speed. This would provide for the possibility of a getaway with a following wind, which would be the worst possible condition to be considered.

The design of the hull should be such as to offer a minimum resistance to motion through the air during flight. It should

also be so designed as to interfere to as small an extent as is possible with the lift to be produced by the wing panels.

It is very necessary that the hull be rugged enough in its construction to withstand the pounding and rough usage to which it will be subjected during times of getaway and landing. Many of these requirements would call for radically opposite methods of construction, and where such conditions arise, the judgment of the designer must be used to effect a compromise



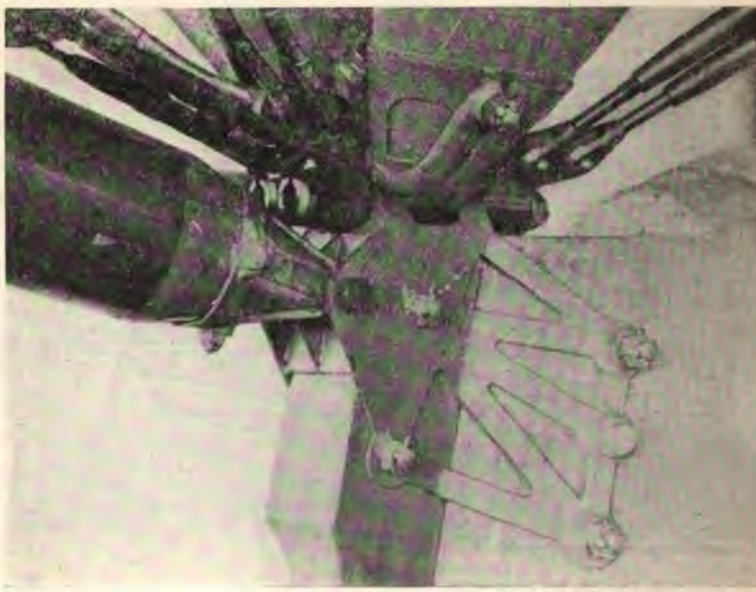
MODEL BASIN TEST CURVES—"NC" HULL.

which will give the most satisfactory operation under the greatest variety of operating conditions.

In determining the characteristics of the hull for a flying boat, a model is made to scale and is tested in the model basin or towing tank in a manner similar to that used in the testing of models of ships. The accompanying curves show the results of the model basin tests of the *NC* hull under three conditions of loading. These curves are self-explanatory.

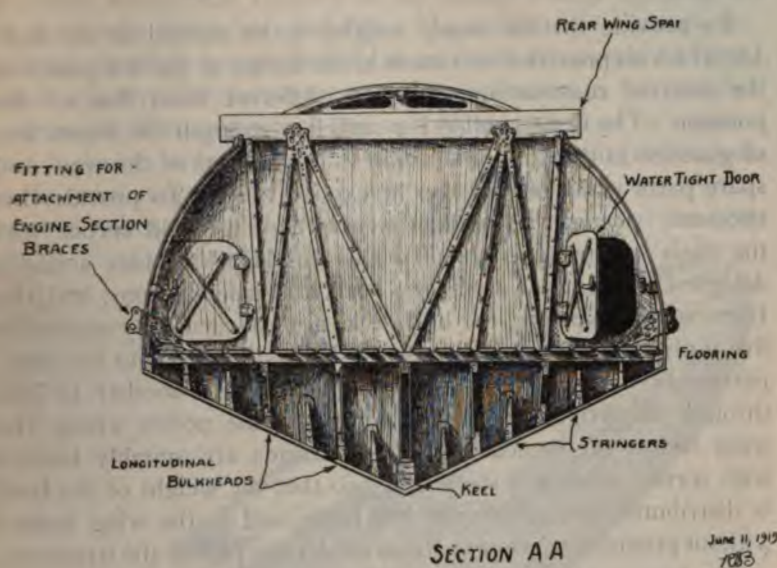
The *NC* type of hull, with the tail surfaces carried on outriggers supported in part from the upper rear wing beam and in part

from the hull stern post, was suggested by Mr. Curtiss in his original proposal. The details of the hull design are largely the work of Commander H. C. Richardson, of the Construction Corps. Commander Richardson had had a very wide experience in the design and testing of pontoons for seaplanes, and, as a result of this experience, was best qualified to take up the design of a new hull of the type to be used for the *NC* flying boat. As the result of his experience in the design and testing of pontoons, he decided

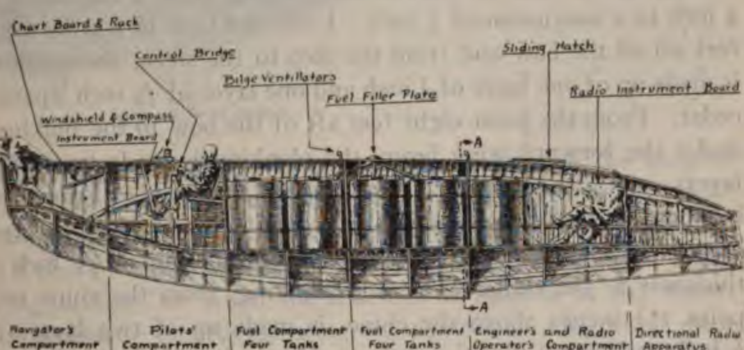


TAIL FITTING AT STERN POST.

that a very satisfactory float could be produced by modifying the design of the *R-6* pontoon which had proved very successful in its use in seaplanes. Accordingly, the general dimensions of the hull were determined by increasing the dimensions of the *R-6* pontoon in the ratio of the cube root of the displacements. The shape of the V-bottom is similar to that of the Curtiss *H-16* flying boat, and to the British *F-5*, which was later adopted by the U. S. Navy. Changes were made in the shape of the deck of the pontoon, at the bow, to allow for a gunner's cockpit, and the stern was changed to allow for the stresses produced due to



CROSS SECTION OF HULL SHOWING WING BEAM SUPPORT AND ATTACHMENT.



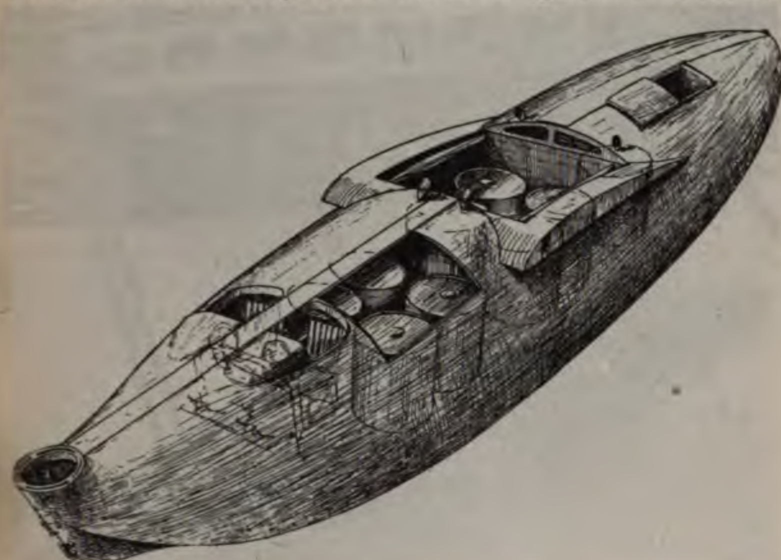
LONGITUDINAL SECTION OF HULL SHOWING TANKS, CONSTRUCTION, BULKHEADS, AND INTERIOR ARANGMENTS.

the weight of the tail surfaces to be supported from the stern of the hull.

To provide for the heavy weights to be carried in the hull, for which no provision was made in the design of the *R-6* pontoon, the internal construction was very different from that of the pontoon. The design called for sufficient strength for 10,000 lbs. of gasoline in the hull, in addition to the weights of the crew and spare parts which would also be carried there. To provide this necessary strength a fuselage structure of ash and spruce was the basis of construction. To this fuselage structure suitably designed floors, floor stringers, keels and side keelsons, and the framework to support the hull deck, are attached. By means of five 2-ply mahogany bulkheads, the hull is divided into six compartments. Access from one compartment to another is had through watertight bulkhead doors. At the points where the wing beams are attached, these bulkheads are suitably braced with spruce strips and steel straps so that the weight of the hull is distributed throughout the bulkheads and to the wing beams without producing excessive strain on any one part of the structure.

The bottom planking of the hull is Spanish cedar, made up in two layers with a layer of batiste and marine glue between. To provide for the pounding of the hull bottom, and to give the required strength with a minimum weight, the bottom planking is made up in various thicknesses ranging from a minimum of $\frac{1}{8}$ inch to a maximum of $\frac{1}{4}$ inch. From the bow to a point eight feet aft of the bow and from the step to the stern, the planking is made up of one layer of $\frac{1}{8}$ inch and one layer of $\frac{3}{16}$ inch Spanish cedar. From the point eight feet aft of the bow to the bulkhead under the forward wing beam, the planking is made up of two layers of Spanish cedar, $\frac{3}{16}$ inch in thickness. From this bulkhead to the step, there is one layer of $\frac{3}{16}$ inch and one layer of $\frac{1}{4}$ inch Spanish cedar, the outer layer tapering to $\frac{3}{16}$ inch in thickness at the chine. The side planking, from the chine to a point $15\frac{1}{2}$ inches above the chine, is made up of two layers of $\frac{1}{8}$ inch mahogany planking. From this point upward, the deck covering is one layer of $\frac{3}{32}$ inch white cedar, covered by light cotton duck, glued to the planking with water-proof glue. In one of the hulls this planking is of thin 3-ply veneer and the duck covering is not used.

As in the design of the other portions of the machine, weight estimates were made as soon as the design had progressed to the point where this was possible. The estimated weight of the hull was found to be considerably in excess of the weight allowed, and it was therefore necessary to make a reduction in this weight. Commander Richardson took this up and, as a result of his experience in design, reduced the sizes of all parts to those he considered as the minimum allowable. Upon a recalculation it was found that the estimated weight came within the figure allowed for hull

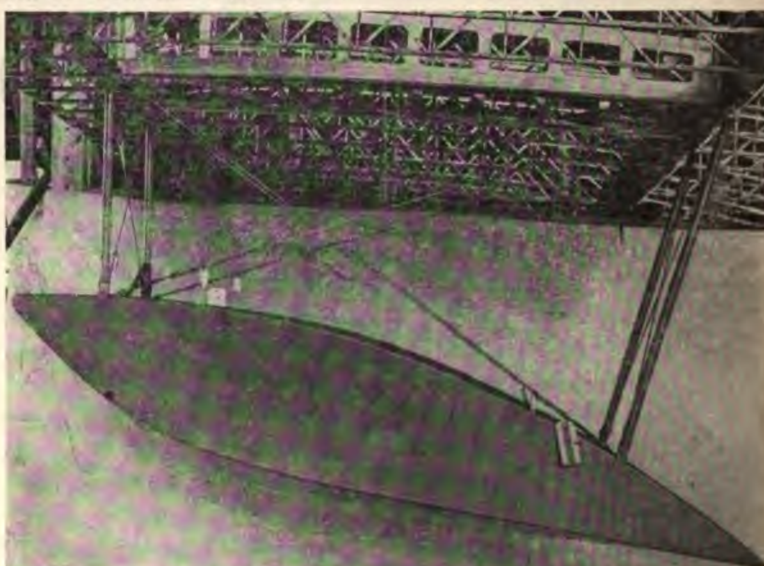


GASOLINE TANKS IN HOLD.

weight. It is interesting to note at this point that the weights of the four hulls as constructed, all exceed the estimated weight of about 2400 lbs. by amounts varying from 100 lbs. to 300 lbs.

To prevent the wing panels coming in contact with the water during taxiing, or when the machine is moored in the water, it is necessary to provide wing tip pontoons. Design of such pontoons is similar in many respects to the design of the hull. They must be especially rugged in their construction because of the great possibility of their being damaged during a bad landing or during landing in a rough sea. They must have a considerable displacement to prevent the wing tips being submerged when

the machine is rolling badly on a rough sea. With the original wing tip pontoon, when the pontoon is completely submerged and the wing tip is about to touch the water, the righting moment is 2.65 times the tipping moment due to the weight of 22,000 lbs. With a load of 29,000 lbs., the righting moment would be double the tipping moment. The size of the pontoon was later increased and the shape changed to overcome the tendency to nose under during taxiing on rough water, with the consequent subjecting



WING TIP PONTOON, ORIGINAL DESIGN.

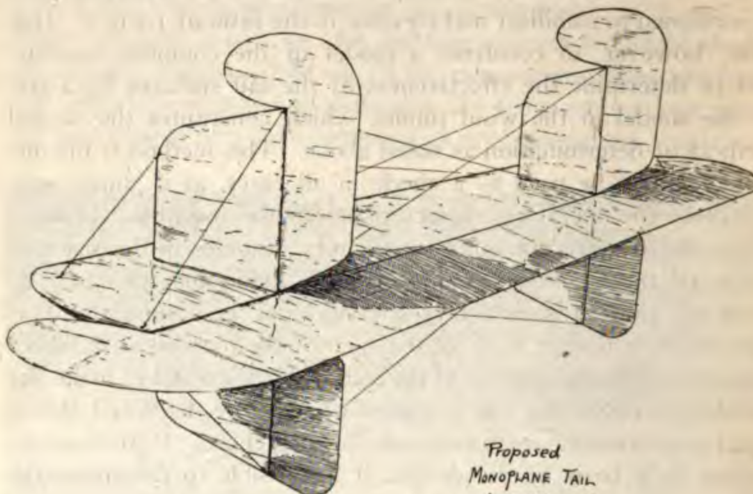
of the wing beams and pontoon struts to very sudden and severe strains.

There are two methods that may be used in determining the areas to be used in the construction of the tail surfaces. One of these is an analytical method which makes use of an equation derived from the consideration of many machines which have been in satisfactory practical use. This equation may be written $a = .51\ AC/L$, where a represents the combined area of the horizontal stabilizer and elevators, A represents the total wing area, C represents the wing chord and L represents the distance between

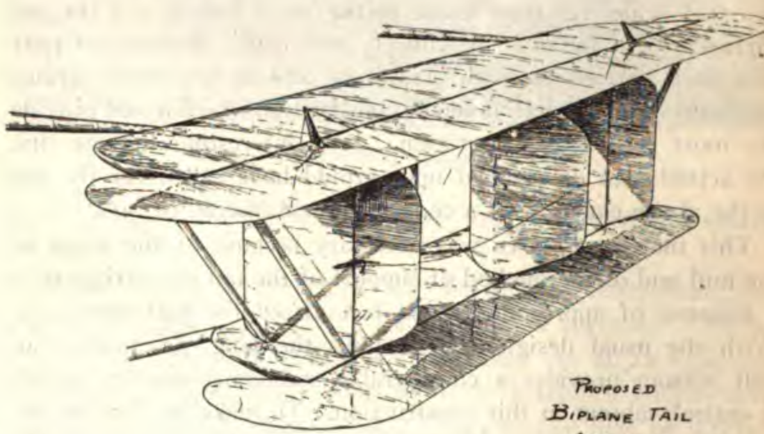
the mean centers of pressure of the wing panels and the tail surfaces. The use of this equation will give an approximate value of the necessary horizontal control areas, which is then apportioned to stabilizer and elevator in the ratio of 1.2 to 1. It is wise, however, to construct a model of the complete machine and to determine the effectiveness of the tail surfaces by a test of the model in the wind tunnel, which constitutes the second method of determination as noted above. This method is the one which should be used as a check in all cases, as it shows very definitely the operating characteristics of the machine. If these characteristics are not quite satisfactory, changes in the size and shape of these control surfaces may be made and tests may be repeated until a satisfactory arrangement is obtained. It is customary in design to make the span of the horizontal stabilizer approximately one quarter of the total wing span and to make the distance between the mean centers of pressure, as noted above, equal to approximately three times the wing chord. With these relations as a basis of the design, it is possible to determine the approximate areas for the control surfaces, and then by means of a wind tunnel test to determine the exact area required.

The analytical method described above was applied to the design of the stabilizer and elevator for the *NC* boat. A model made to exact scale was then tested in the wind tunnel, and the tail surfaces were found to be entirely too small. A series of tests was then carried on with stabilizers and elevators of various sizes and shapes to determine the construction which would provide for most satisfactory operation. It is interesting to note that the actual area determined upon would have called for the use in the above equation of a constant of .68 instead of .51.

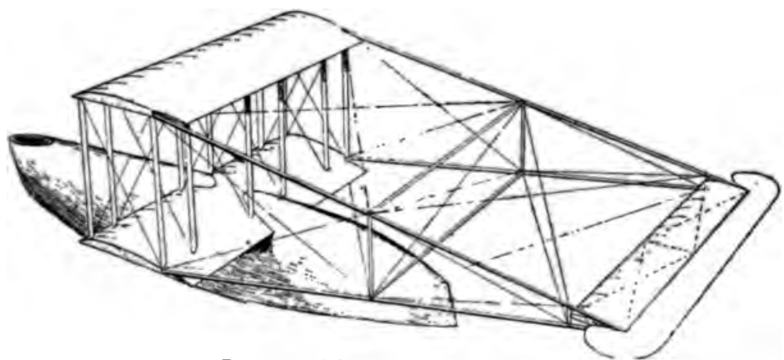
This increase of area was necessary because of the shape of the hull and of the method of support of the tail on outriggers at a distance of approximately 20 feet aft of the hull stern post. With the usual design of boat hulls the long, practically flat, hull bottom provides a considerable stabilizing surface, which is entirely absent in this construction. To make up for this decrease in hull surface, additional area must be provided in the horizontal stabilizer. This is true also of the vertical stabilizers, which were of a larger proportional area than is used on the conventional type of flying boat.



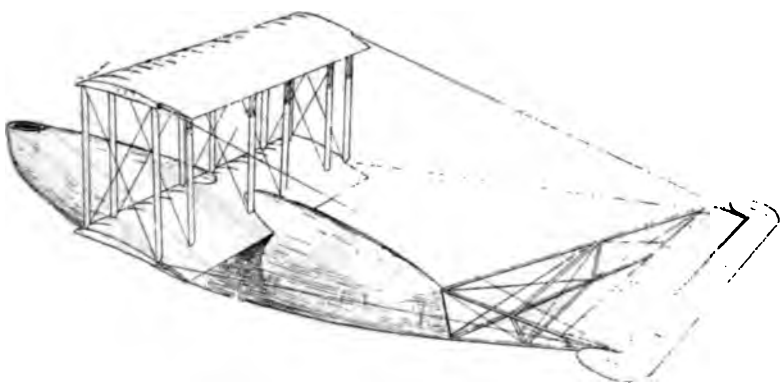
Proposed
MONOPLANE TAIL
ARRANGEMENT



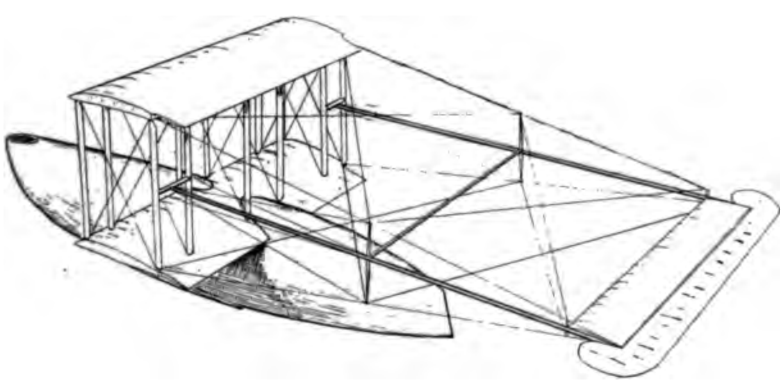
PROPOSED
BIPLANE TAIL
ARRANGEMENT



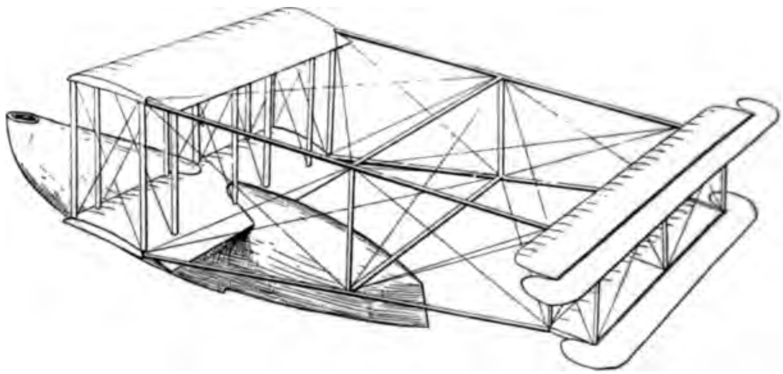
PROPOSED MONOPLANE TAIL NO. 1.



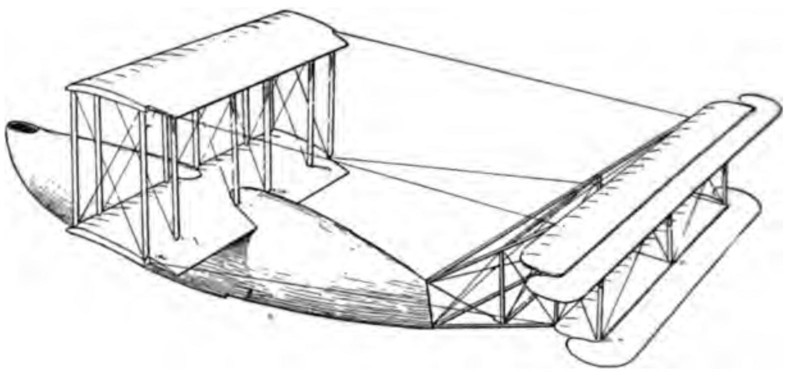
PROPOSED MONOPLANE TAIL NO. 2.



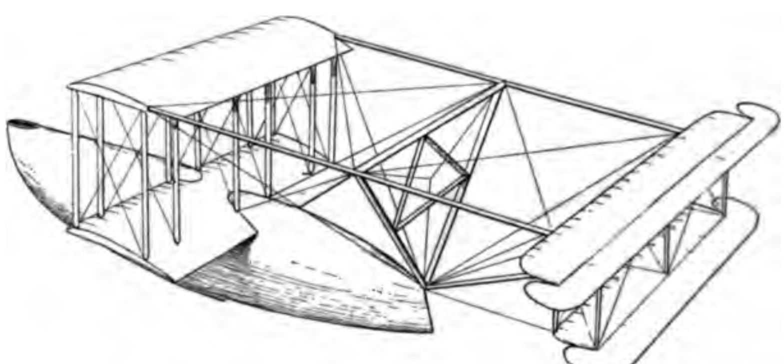
PROPOSED MONOPLANE TAIL NO. 3.



PROPOSED BIPLANE TAIL NO. 1.

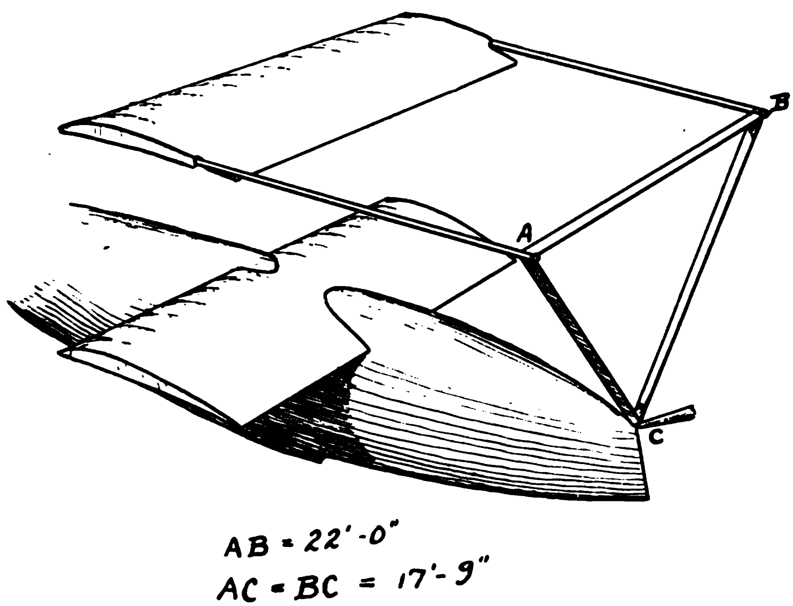


PROPOSED BIPLANE TAIL NO. 2.



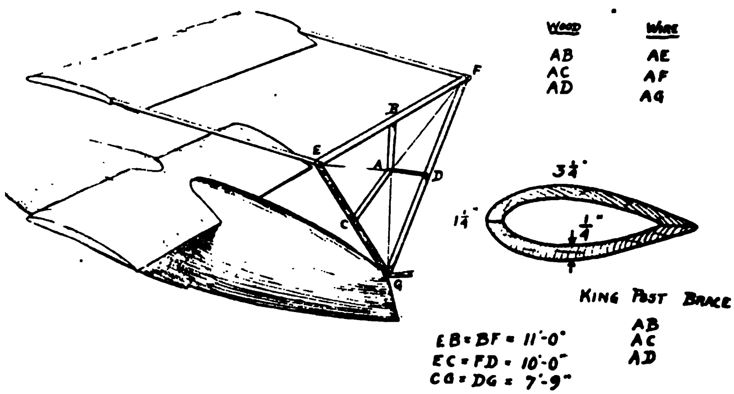
PROPOSED BIPLANE TAIL NO. 3.

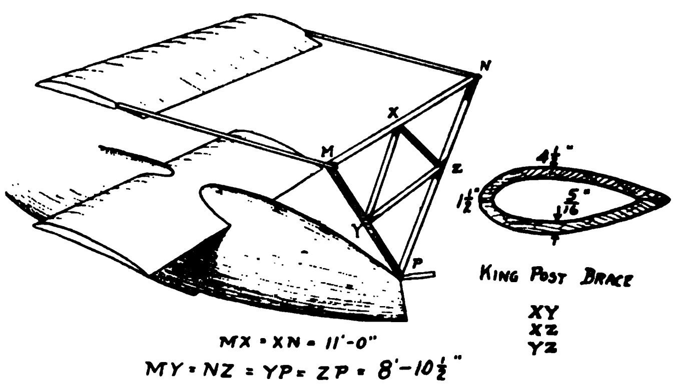
In determining upon the type of tail surfaces to be used for this design, four important factors were considered. These were, first, the weight of the total structure; second, the stresses set up in structural members other than those used directly in the support of the tail; third, the rigidity of the complete structure; and fourth, the possibilities of destroying any single member without the destroying of the entire structure.



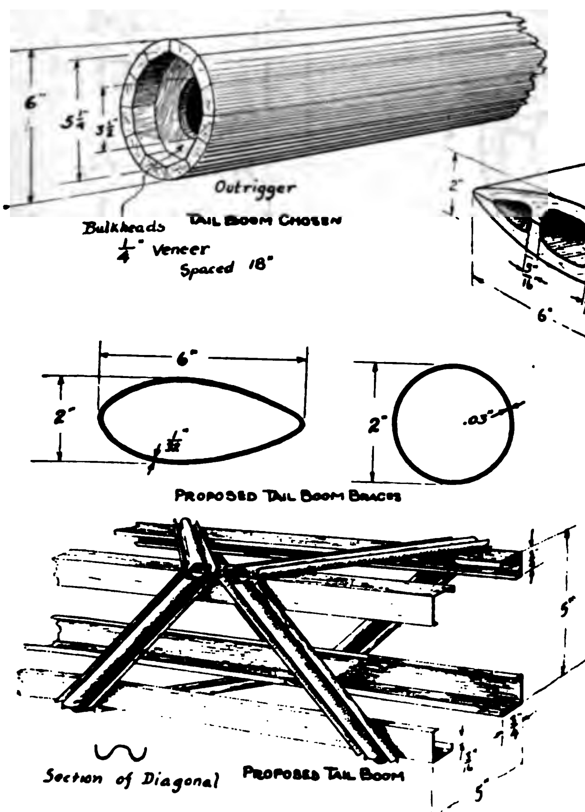
BRACING OF TAIL BOOMS.

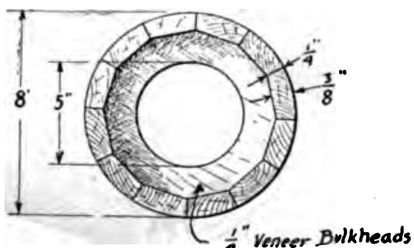
In determining the type of tail surface to be used for the *NC* boats, various arrangements of both monoplane and biplane tails were considered. These two types of tails and the various means of supporting them are shown in the accompanying sketches. Without attempting to go into a detailed discussion of the various types considered, it seems sufficient to state that the type chosen as the most satisfactory was the biplane tail No. 3. The main reasons for the choice of this tail were that it was the most rigid in construction, that it actually reduced the stresses in the wing



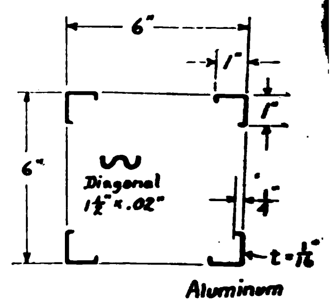


KING POSTING OR BRACING OF TAIL BOOMS

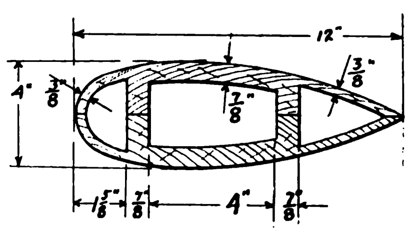

6"
Outrigger
Bulkheads
Veneer
Spaced 18"
TAIL BOOM CHOSEN
2"
6"
King Post
TAIL.
6"
2"
2"
.03"
PROPOSED TAIL BOOM BRACES
5"
5"
Section of Diagonal
PROPOSED TAIL BOOM



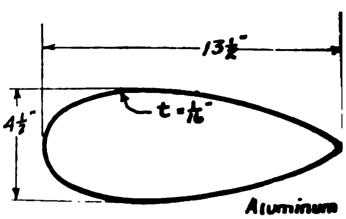
PROPOSED TAIL BOOM



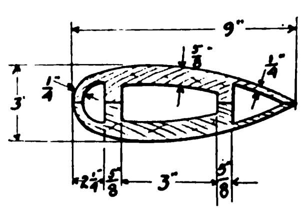
PROPOSED TAIL BOOMS

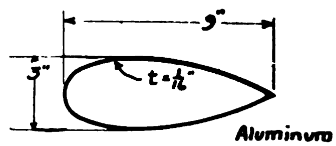


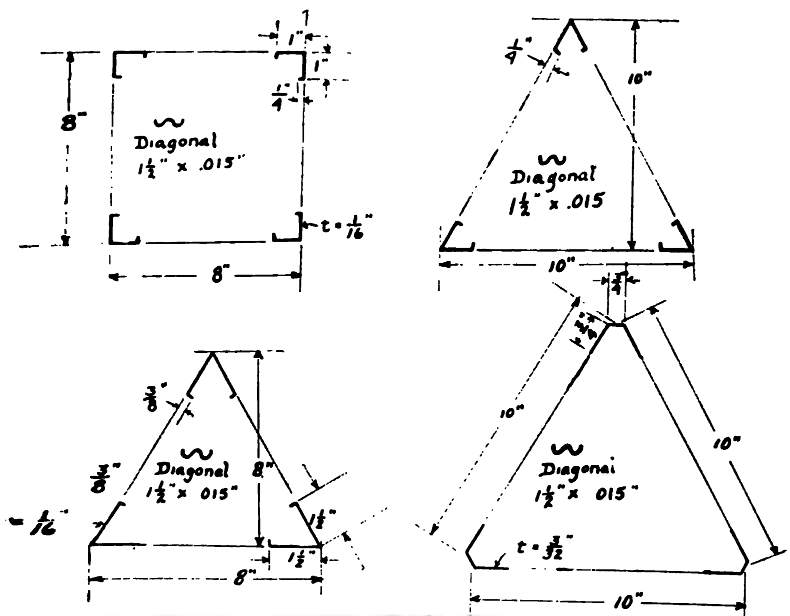
TAIL BOOM BRACES USED

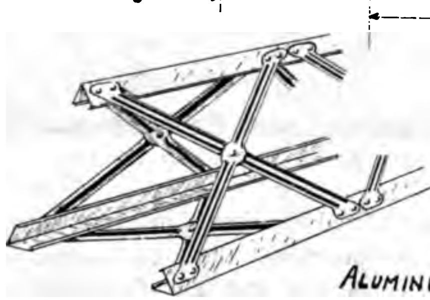


TAIL BOOM BRACES PROPOSED







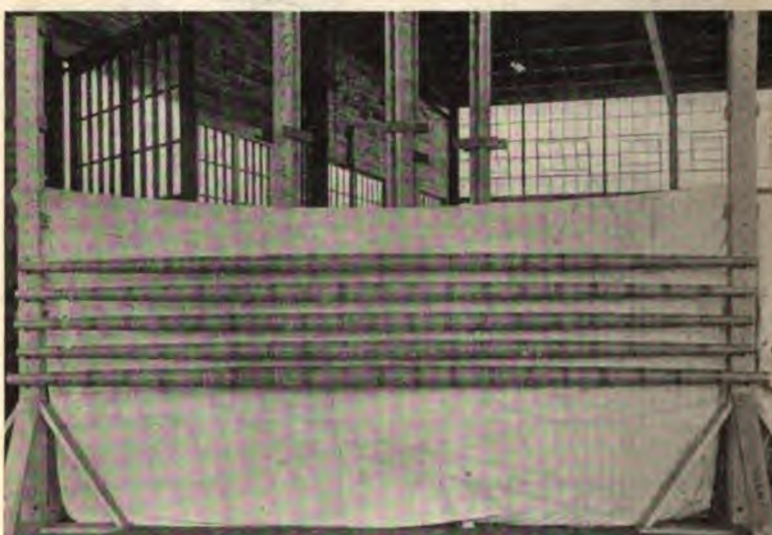


PROPOSED TAIL BOOM.

ALUMINUM
OUTRIGGER SECTIONS

beams instead of increasing these stresses, and that there was less possibility of failure of the entire structure due to a failure of any one of the supporting wires or cables. The actual weight of the structure is somewhat greater than the estimated weights of some of the other arrangements, but this factor is thought to be less important than the other three mentioned above.

In the investigation of methods of support of the tail, outriggers built of aluminum, steel, and spruce were compared.

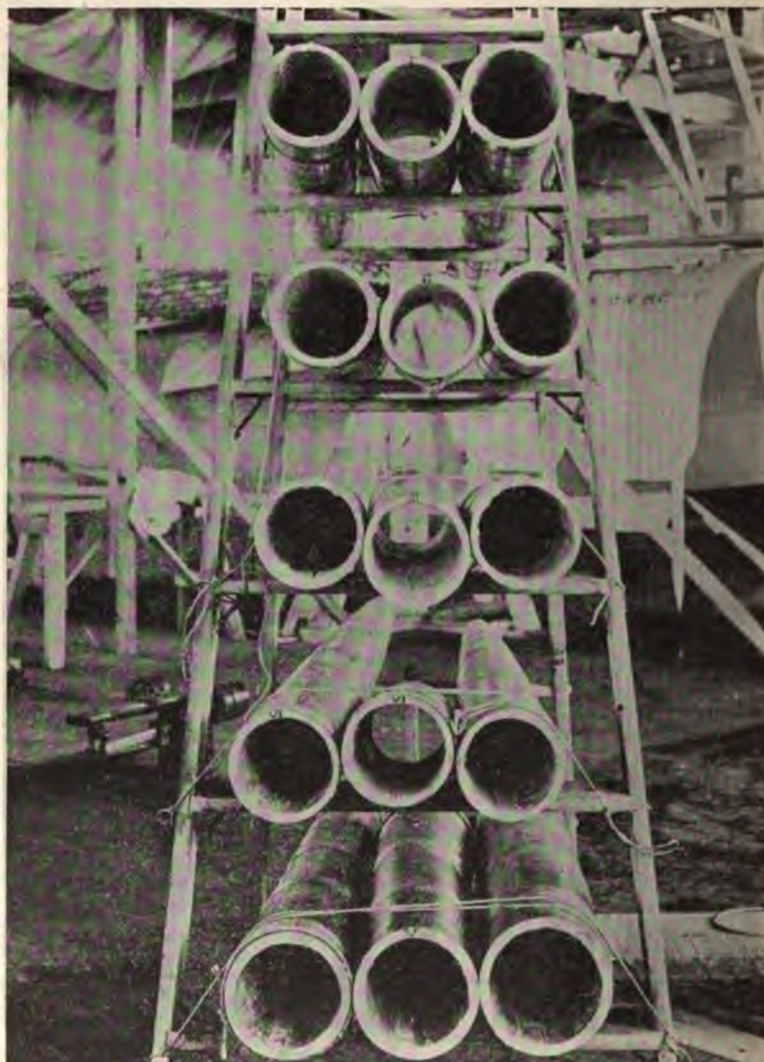


TAIL OUTRIGGERS, AFTER COMPRESSION TESTS.

The various sections considered are shown in the accompanying sketches. Here again, for practically the same reasons as have been outlined above in connection with the discussion of wing struts and wing beams, the spruce seemed to promise the most satisfactory conditions for construction and for use, and, therefore, this material was chosen.

Before this design was entirely detailed, a model of the complete plane was tested at the Washington Navy Yard wind tunnel. A similar model was made later and tested in the wind tunnel of the Curtiss Engineering Corporation. The curves

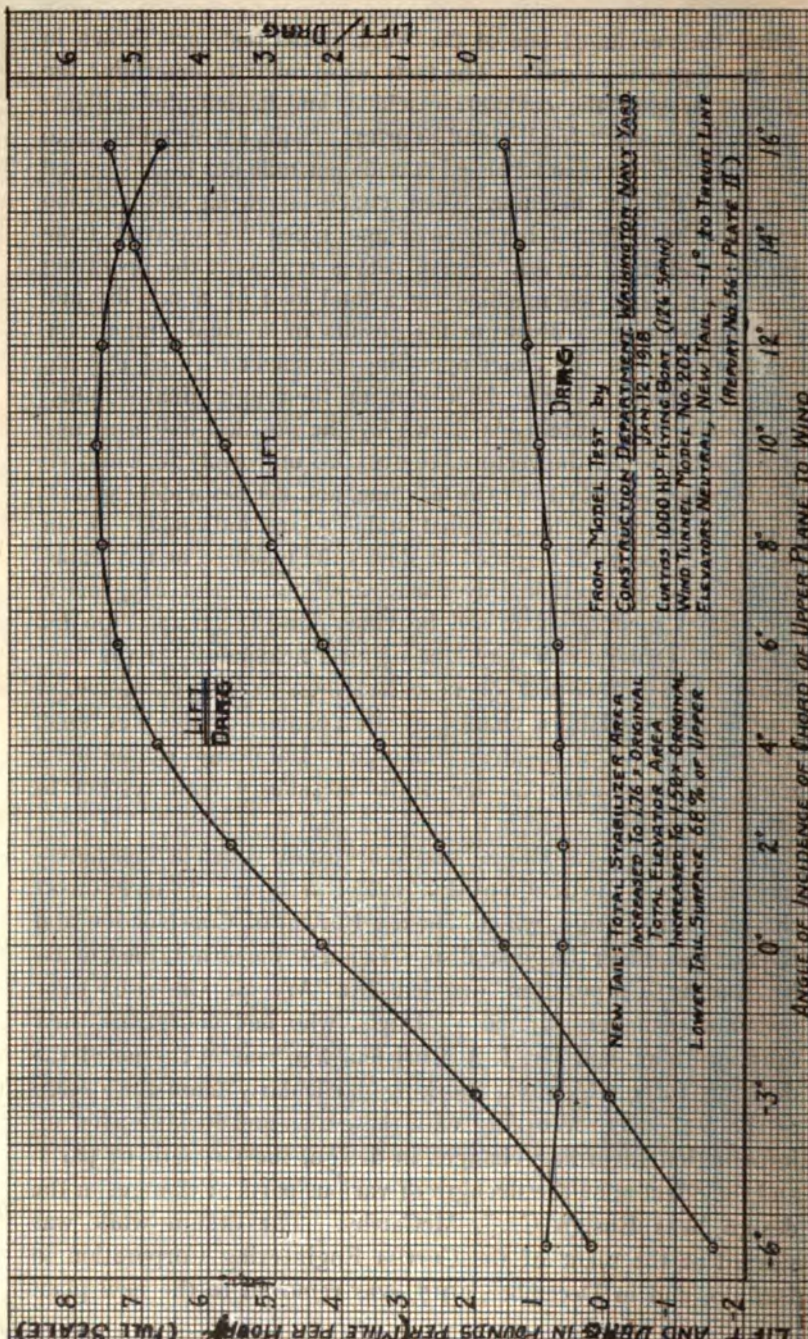
SECTIONS OF TAIL OUTRIGGERS, SHOWING POINTS OF FAILURE DUE TO COMPRESSION TESTS.

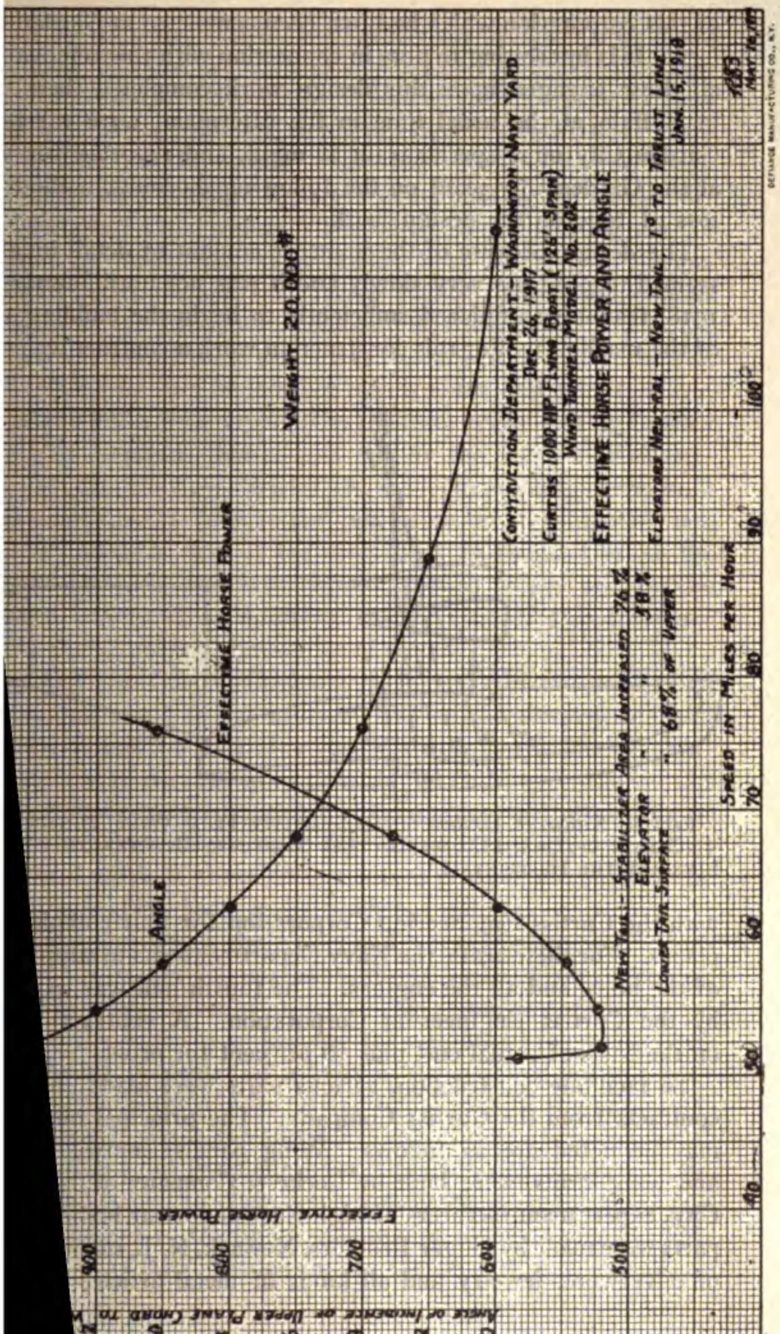


CUT SECTIONS OF TAIL OUTRIGGERS, AFTER COMPRESSION TESTS.

giving the results of one of the wind tunnel tests are shown in the accompanying figure. The tests were made to determine the lift and drag of the complete machine, and its longitudinal stability. The curves for lift and drag are shown corrected so as to give the coefficients in terms of pounds per mile per hour squared for the full-size machine. The curves showing the relation between the required horsepower and speed are derived from the lift and drag curves. These curves represent the operating characteristics of the machine for a total load of 20,000 lbs. and are used simply to illustrate the results of a wind tunnel test, and not to show the exact operating characteristics of the *NC* type of seaplane. In the chart showing the longitudinal stability, the condition of stability is shown by the position and direction of the vectors. If the vectors are grouped uniformly fore and aft of the center of gravity of the machine, and not too widely spaced, good conditions of longitudinal stability are indicated. If the vectors are too widely spaced, it shows the machine as too stable. If they are grouped mainly forward of the center of gravity, it indicates a condition of tail heaviness, and if grouped too far aft of the center of gravity, one of nose heaviness. If the condition of tail heaviness or nose heaviness is not excessive, it can be corrected by a change in the position of the elevators; if it is excessive, it requires a change in the design of the horizontal stabilizer or a change of its angularity with respect to the wing panels.

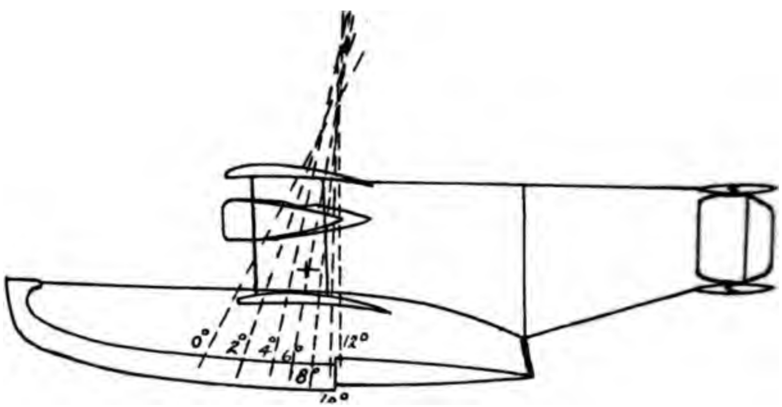
The conditions as outlined above are those which it was necessary to meet in the design of this type of machine. To have direct charge of the design, which, for the Bureau of Construction and Repair, was under the general supervision of the writer, the Curtiss Enginering Corporation detailed Mr. W. L. Gilmore, their assistant manager, Mr. S. V. Davis, who had charge of their drafting room, and Mr. J. A. Christen, who was in charge of the drafting force which was working particularly upon the design of the *NC* parts. Working with these men and looking after all information regarding changes in design, the strength of parts, and the effect upon the strength of various parts of changes in the design, was Ensign C. J. McCarthy. The design work was started at the plant of the Curtiss Engineering Corporation in Buffalo, and in December, 1917, was removed to the new plant


NEW TAIL: TOTAL STABILIZER AREA INCREASED TO 1.76 x ORIGINAL
TOTAL ELEVATOR AREA INCREASED TO 1.58 x ORIGINAL
LOWER TAIL SURFACE 68% OF UPPER
FROM MODEL TEST by
CONSTRUCTION DEPARTMENT WASHINGTON NAVY YARD
JAN 12, 1918
CURTISS 1000 HP FLYING BOAT (126' SPAN)
WIND TUNNEL MODEL No. 202
ELEVATORS NEUTRAL, NEW TAIL, -1° TO THRUST LINE
(REPORT No 56: PLATE II)
LIFT
DRAG
LIFT / DRAG
ANGLE OF INCIDENCE OF CHORD OF UPPER PLANE TO WIND
LIFT AND DRAG IN POUNDS PER (MILE PER HOUR)² (FULL SCALE)


CONSTRUCTION DEPARTMENT - WASHINGTON NAVY YARD
DEC 26, 1917
CURTISS 1000 HP FLYING BOAT (126' SPAN)
WIND TUNNEL MODEL No. 202
EFFECTIVE HORSE POWER AND ANGLE
WEIGHT 20,000#
EFFECTIVE HORSE POWER
ANGLE
SPEED IN MILES PER HOUR
40
50
60
70
80
90
100

of this corporation which had just been completed at Garden City, L. I. It is interesting to note in connection with this removal that all those engaged upon this design work completed their work in Buffalo at the usual time in the afternoon, were carried to Garden City on a special train at night, and reported for work at the Garden City plant on the following morning, without any loss of time on the design work.

The design, because of the immense amount of detail involved, seemed to progress very slowly and it was not until January 19, 1918, that it was finished sufficiently to begin the building work of the machines. For this construction work a contract was made



VECTORS SHOWING LONGITUDINAL STABILITY FROM WIND TUNNEL DATA + CENTER OF GRAVITY. ANGLES ARE MEASURED BETWEEN THE THRUST LINE AND THE HORIZONTAL.

with the Curtiss Engineering Corporation for four complete seaplanes. For these craft, the Navy Department was to supply three of the hulls, and all the engines. The fourth hull was to be built by the Curtiss Engineering Corporation. A contract was let on the basis of actual cost plus 10 per cent for profit.

To facilitate construction, various parts were made under subcontracts from the Curtiss Company. The principal ones which may be noted are as follows. Wing panels, control surfaces, and wing struts, were built by Locke & Company of New York City, expert manufacturers of high-class motor car bodies. Metal parts were made by Unger Brothers, Newark, N. J., manufacturers of silverware, jewelry and all kinds of metal articles ordinarily

handled by jewelers. Later, to expedite the production of metal parts, some of these were manufactured by the Beaver Machine Works of Newark, and some by Brewster and Company of New York City. Wing tip floats were built by the Albany Boat Company, builders of high-class steam launches and motor boats. These, later were replaced by larger floats built by the Naval Aircraft factory of Philadelphia. The outriggers supporting the tail were built by the Pigeon-Fraser Hollow Spar Company of Boston, makers of masts and spars for racing yachts. The gasoline tanks were built by the Aluminum Company of America of Pittsburgh. The construction of these tanks was the largest and most difficult job of this nature ever undertaken by any aluminum manufacturer. Two of the hulls to be supplied by the navy were built by Lawley & Sons of Neponsit, Mass., and one by the Herreshoff Manufacturing Company of Bristol, R. I. These hulls were built on the basis of cost, plus 10 per cent profit on an estimated cost, with the understanding, if the cost could be reduced below the estimated cost, the contractor would be paid 10 per cent on the estimated cost, and, in addition, 25 per cent of the difference between the actual and the estimated costs.

To assist the Curtiss Company in expediting the production of these parts, and to aid in every way in the construction and assembly of the machine, four officers attached to the office of the writer, were detailed to work with Mr. Gilmore of the Curtiss Engineering Corporation, who had been placed in full charge of the construction work on these four machines. Only because of the faithful work of these officers was it possible to complete the first of these flying boats in September, 1918.

This boat, known as the *NC-1*, had a power plant which consisted of three low compression direct drive liberty engines, arranged to drive tractor propellers. This arrangement was chosen because of the necessity of keeping the weights of the motors forward to bring the center of gravity in the required position with respect to the center of lift. After actual tests of the machine it was found that slight variations in the position of the center of gravity had practically no effect upon its operating characteristics, and it was decided to change the arrangement on the third and fourth boats to two tractor motors and one pusher motor. This installation was later decided on for the second boat as well.

The *NC-1* was completed and assembled for tests at the Roc- way Beach Naval Air Station in September, 1918. The engi were tried out for the first time on October 1, and the boat weighed, to determine the total bare weight, on October In weighing this machine, four platform scales of 8000 capacity each were used. These scales were so placed t jacks resting upon the scale platforms could be placed direc under the engine section wing beams, at the outer strut statio By jacking up, the entire weight of the machine was transferr to these four points. The summation of the four scale readi

"NC-1" ORIGINAL 3-MOTOR INSTALLATION.

gave the weight of the plane. By carefully adjusting the position of the machine, leveling it fore and aft and transversely, the weights as indicated on the scales made possible the calculation of the fore and aft position of the center of gravity. The total weight was 12,740 lbs. This weight did not include any supplies or equipment. It was the net bare weight of the machine itself. The estimated weight for the complete machine as worked out by the Curtiss Engineering Corporation was 11,900 lbs., 840 lbs. or 6.6 per cent less than the actual weight. The center of gravity was 65 inches aft of the leading edge of the lower engine section wing panel, or 28 inches aft of the mean center of lift of the wing panels. This condition indicated very decided tail heaviness, and, in the first

rial flight which was made, it was decided to place in the bow f the machine, 15 feet forward of the leading edge of the lower ngine section wing panel, a sand load of 1755 lbs., so that with he weights of cooling water, pilots, mechanicians, fuel and oil, he center of gravity would coincide with the center of lift. This vould bring the gross weight of the machine in flying condition ip to 16,500 lbs.

The first test of the *NC-1* was made on October 4, 1918. In this test, though the craft was very tail heavy, its operation as a whole was very satisfactory, and indicated that the work of the

"NC-1" TAXIING.

designers had been a success. It was found necessary, subsequently, to make slight changes in the position of the horizontal stabilizer to neutralize this tail heavy condition, but, otherwise, no radical changes were necessary in the design or construction.

It might be interesting at this point to note briefly some of the opinions of this craft gathered during the time of its construction. After the hull of the first machine had been completed and preliminary assembly had been partly carried out, Colonel Porte of the Royal Air Force, who had been associated with Mr. Glenn Curtiss in the design of the *America*, the boat which was built in 1914 for Mr. Rodman Wanamaker, for a trans-Atlantic flight, visited the Curtiss Engineering Plant and looked

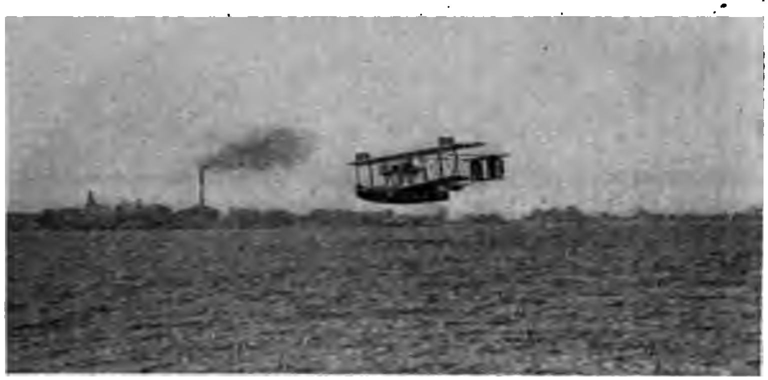
over the *NC-1*. At that time, Colonel Porte would make no comment beyond the simple statement, "it is very interesting," but from statements made by others who had come in contact with Colonel Porte shortly after this visit, it is evident that his opinion of the boat, if it had been stated, would have been far from encouraging. In July, 1918, a British Aviation Commission headed by Major General Brancker and including as a principal technical officer, Colonel Sempill, of the Royal Air Force, also inspected the boat. Colonel Sempill, in a report upon his return to England, commented as follows: "The hull of this machine was examined and is the design of a naval constructor. The

"NC-1" PLANING.

machine is impossible and is not likely to be of any use whatever." Several people of considerable airplane design experience stated frankly their doubts of the ability of the hull to get the craft into the air, and even Mr. Curtiss himself thought the planing surface of the boat hull insufficient. These are only samples of the opinions which were held by many persons of the design of this machine. The gratification of those connected with the design due to the successful operation of the completed plane can be imagined.

The tests made on the *NC-1* showed operating characteristics very much better, as regards lifting capacity, and speed in the air, than had been indicated by the wind tunnel tests. With the three low compression tractor engines, it got away with a load of 22,000

lbs. at a speed of 52 miles per hour, after planing approximately one minute. The wind tunnel experiments had indicated a getaway speed of approximately 60 miles per hour and a maximum speed of approximately 72 miles per hour with this load. The actual test showed a maximum speed in still air of approximately 80 miles per hour. Because of this exceptionally good showing, it was decided to install high compression engines to determine what load could be handled in this way. Tests made with high compression engines showed the maximum lifting capacity to be 24,780 lbs., as compared with the original 22,000 lbs. for which the craft



"NC-1" ON TRIAL FLIGHT.

was designed. The getaway with this load was made under very unfavorable conditions as to wind and tide, and it is very probable that with more favorable conditions, the three high compression engines would have been able to lift 25,000 lbs.

Because of the possibility which seemed to be indicated, of the machine handling much heavier loads than the 25,000 lbs. just mentioned, it was decided to install an additional engine and make tests to determine the limit of loading of the machine. Accordingly, the *NC-2* was equipped with four high compression Liberty engines, arranged one tractor and one pusher in tandem in a nacelle on each side of the center nacelle. The pilots and controls remained in the center nacelle as in the original design. With

this arrangement of engines, the machine got away successfully with a load of 28,100 lbs.

There are several objections to the double tandem arrangement of engines described in the preceding paragraph. The efficiency of operation of the two engines in tandem can never be equal to the efficiency of operation if the two engines were set up in separate nacelles; in case of failure of one of the tractor engines, the pusher engine becomes exceedingly inefficient because of the propeller of this engine having been designed to operate

DOCKING THE "NC-2."

in the slip stream of the tractor engine; and there is an excessive torque on the rudder which would result from an attempt to keep the plane to its course if one or both of the engines in one of the tandem nacelles should fail in operation.

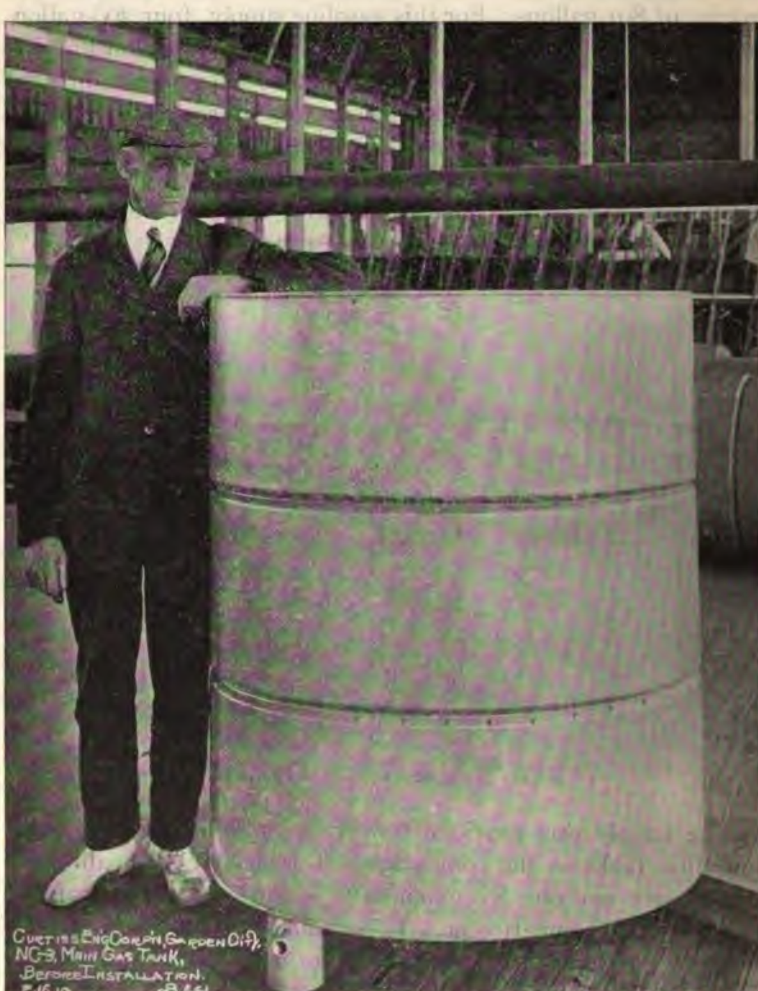
To obviate as far as possible the difficulties just outlined, it was decided to install in the *NC-3* and *NC-4*, four engines arranged with one tractor and one pusher in tandem in the center nacelle, and one tractor engine in a nacelle on each side of the center. This arrangement would provide for a better efficiency of operation and for fewer difficulties in operation due to breakdown of any one of the engines. Trials made on the *NC*

NC-*4* proved this arrangement very satisfactory and it was pted for the installation to be used on the trans-Atlantic flight. The original design of the *NC-1* provided for a total gasoline pacity of 891 gallons. For this gasoline supply, four 200-gallon uminum tanks were placed in the hull, and a 91-gallon gravity nk was placed in the upper engine section wing panel, directly bove the center nacelle. This capacity was later increased by the addition of two 200-gallon gasoline tanks in the hull compartment forward of the main tank department. When the power plant was changed to four motors instead of three a further increase in

"NC-4" BEACHED BETWEEN FLIGHTS.

gasoline supply was provided for by the addition of two more 200-gallon tanks in the compartment forward of the main tank compartment and one 200-gallon tank in the compartment aft of the main tank compartment. These tanks are all connected by means of aluminum tubing so gasoline may be drawn from all tanks equally. Valves make possible the shutting off of any tank in case of leakage, or the proper adjustment of the center of gravity of the machine, by regulating the gasoline drawn from any tank.

Gasoline is supplied, by means of air driven plunger pumps placed on the hull deck, from the main tanks to a 91-gallon aluminum gravity tank, carried in the center of the upper engine section wing panel as noted previously. This tank is of the same



A 200-GALLON ALUMINUM GASOLINE TANK.

depth as the panel and is designed to have sufficient strength to carry the flying load corresponding to its area. For emergency use, a hand pump is also installed. An overflow line is provided from the gravity tank to the main tanks, and a glass cup connected in this line gives a visible indication of the operation of the pumps. One pump when operating properly, has sufficient capacity to cause a continuous overflow from the gravity tank. Two pumps are provided, and, with the hand pump, insure at all times an adequate supply to the gravity tank.

LIEUT. COMMANDER A. C. READ (CENTER), COMMANDING OFFICER AND NAVIGATOR; LIEUTENANT E. F. STONE (RIGHT) AND LIEUTENANT (J. G.) W. HINTON (LEFT), PILOTS, OF "NC-4" ON THE TRANSATLANTIC FLIGHT.

The gasoline is distributed from the gravity tank to the motors through aluminum tubing, with hand operated brass cut-off valves of the globe type connected in the lines just below the gravity tank. Aluminum cock-valves were used originally, but these were unsatisfactory, due to sticking of the valve. With the cut-off valves open, the supply of gasoline to the carburetor is regulated by the float, the controls for which are located in the pilots' cockpit. The two outer motors are operated through a differential throttle control, and the center pusher and the center tractor have individual throttle controls.

Lubricating oil for the engines is carried in aluminum oil tanks, supported on extensions of the engine bearers. These tanks have a capacity of 40 gallons for each engine. From results obtained in operation, this capacity is much more than is required for the longest lap of the trans-Atlantic flight, 1300 miles. Indications are that 25 gallons per motor would have been more than adequate for this supply.

Radiators are of the honeycomb type. Plate radiators have been tried in the operation of the craft, but had not proved satis-

VIEW OF PILOT'S SEATS, "NC-4."

factory, due to insufficient strength to withstand stresses set up during operation of the plane. With a stronger construction these radiators could be made satisfactory for operation, but it is questionable whether the reduction in head resistance obtained would compensate for the increased weight.

Controls are of the Deperdussin type, so built that two pilots seated side by side can, in case of need in rough air, work together on the operation of the controls. In the pilots' compartment is an instrument board, electric lighted, carrying an air speed meter, an altimeter, tachometers and spark retards. In the engineers' compartment in the hull is a second instrument board, with radiator, water and oil thermometers and oil pressure gauges attached.

The engineer on watch is held responsible for the satisfactory operation of the engines, and can tell from the readings on the instrument board what changes in conditions are necessary to make the operation satisfactory.

To provide a reserve of cooling water, a 20-gallon auxiliary water tank is carried in the hull. By means of a system of copper piping and a hand pump, water may be supplied to any one of the four radiators. The radiator vent pipes are attached to copper tubes leading back to the auxiliary tank. In this way any vapor or steam formed in the radiators is condensed in the tubes and led back to the supply tank. The only loss of water, therefore, would be due to leakage.

In the engineers' compartment are located, also, the wireless telegraph and wireless telephone instruments. The former is made up of two sets, one for use in the air with 100-feet antennæ trailing downward from the tail support, and with power supplied from an air driven generator, and an auxiliary set for use when on the water, with the antennæ carried on the skid fin masts above the upper wing panels, or for emergency in the air, a short trailing antennæ. The former set has a radius of 300 miles, and the latter one of 75 miles. The latter set was so arranged that it could be used also for the wireless telephone connections. For communication between members of the crew of a boat, an intercommunicating telephone set was provided. Connections of this set were so arranged that the wireless telephone receiving set could be plugged into the intercommunicating set, and all members of the crew could hear reports coming in by wireless telephone.

In the stern compartment there is installed a wireless direction finding compass. This is an adjustable wireless receiving coil, with an indicator attached. As the position of the coil is changed the intensity of the sound in the wireless receiver changes. When this sound is a maximum, the indicator attached to the movable coil gives the bearing of the sending station.

Such is the story of the design and construction of the *NC* flying boats. The performance of these machines in the recent trans-Atlantic flight, both in the air and on the water, shows the excellent results that may be obtained by the application of real engineering principles of design to the solution of problems seemingly as impossible of solution as was this one when first proposed by Admiral Taylor.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A POST GRADUATE COURSE IN EXPOSITION

By H. C. WASHBURN, U. S. Naval Academy

INTRODUCTION

In 1916, at the request of the Secretary of the Navy, the Society for the Promotion of Engineering Education appointed a committee to inspect the Post Graduate School of the Naval Academy, and to make recommendations concerning its needs, as well as to compare it with other technical schools. Among the recommendations of this committee was the following:

> The work of the Post Graduate School should not be confined to the year which the students spend at Annapolis. The school should be a living force permeating the entire corps of officers of the Navy. All graduates of the Naval Academy, in whatever branch of the service, should be encouraged to correspond with the officers of the Post Graduate School and to resort to them for advice and assistance in any technical problems with which they may have to deal. The Post Graduate Department should send out printed or typewritten information which it considers of service to officers, and should keep in touch with them after graduation. The School must not become an . . . . institution for a few . . . . men. Every officer in the Navy should feel that it is his school whether he has ever been a student there or not. . . . . The School should be liberally supported by Congress, and recognized as a most important and valuable branch of the Navy Department.

Further to accentuate the increasing importance and the enlarged possibilities of the school, two concrete illustrations will suffice: First, the Post Graduate School now has a large and well-equipped building of its own. Since its foundation as the School of Marine Engineering in 1909, and until its studies were temporarily stopped by mobilization in 1917, it had occupied cramped and inadequate quarters in the loft of the Marine Engineering and Naval Construction building, Isherwood Hall. It opened its post-war career, however, in the spacious structure

formerly used as the Marine Barracks, which for some months previous had been thoroughly remodeled and renovated. Secondly, as evidence of the complete recognition of the school's standing and prestige, it is worth while to quote from the address delivered by the Secretary of the Navy at the opening exercises, June 16, 1919. Mr. Daniels then said, in effect, that in the future no naval officer "should reach the rank of captain unless he had had engineering experience, and particularly in this Post Graduate School."

This article on one of the so-called non-technical courses at the Post Graduate School is written, then, partly because it is consonant with the recommendations of the visiting committee in 1916, and partly as the beginning, however modest, of a possible series of articles in the Naval Institute which shall keep the naval service in touch with the school, and, what the committee might well have added, as equally or more important, keep the school in touch with the service, by discussion and correspondence.

One of the less strictly technical courses at the Post Graduate School is chosen as the subject of this article because the scientific courses in the curriculum are being reorganized, and the methods to be followed in the near future, no less than the schedule, have not as yet been definitely decided upon.

RECENT DEVELOPMENTS IN ENGINEERING EDUCATION

Before describing, however, a specific course in Exposition adapted to the requirements of the Post Graduate School, it seems necessary to consider the fact that the circumstances to be found at a post graduate school for naval officers differ to a considerable degree from the circumstances to be found at the leading civilian technical colleges. Not only is the naval profession distinct from all others, but the time available for all courses at the Navy's Post Graduate School is much less than the time given to study at institutions of a technical character with which it may to some extent be compared.

For these reasons the problem involved in planning a course in English for the Post Graduate School at Annapolis will be more clearly understood if we outline the background, or the recent developments in engineering education which have aroused the keenest interest of leading engineers, engineering societies,

and the presidents and faculties of engineering schools. A brief review is therefore given of recent discussions tending to improve courses in English for technical institutions.

Although the Society for the Promotion of Engineering Education was founded in 1892, and has held annual meetings since then, there is as yet no general agreement as to the material and methods to be used in English courses. *Engineering Education*, the magazine of the Society, established in 1918, has published in almost every month's issue one or more articles discussing the question, and the Society has appointed a standing committee to investigate the problems involved in English courses. This committee on English is composed of C. W. Park, Chairman, University of Cincinnati; Frank Aydelotte, Massachusetts Institute of Technology; J. R. Nelson, University of Michigan; and S. A. Harbarger, New York City. In its preliminary report (*Engineering Education*, June, 1919) the committee makes the following statement: "From communications received since the re-opening of the colleges, it is evident that the temporary suspension of the usual courses has been in some respects beneficial. Instructors show a disposition to revise their subject matter and methods, and they bring to the revision a variety of experience and a fresh point of view, gained in some form of war service. The new start in all lines of instruction makes the time a propitious one for a re-examination and, where desirable, a reconstruction of the curriculum." It is evident from the foregoing statement that the committee expects substantial improvements in the teaching of English in engineering schools; it is also evident that at the present time they consider the situation to be in general unsatisfactory.

Their report then refers, as might be expected, to the most thorough investigation of engineering education ever undertaken, namely, that of Dr. Charles R. Mann, whose report upon his three years and more of effort devoted solely to this subject was published in 1918 by the Carnegie Foundation for the advancement of Teaching. In order to appreciate the value of Dr. Mann's report, and hence give it its true weight, it should be understood that his exhaustive investigation—to quote the President of the Carnegie Foundation, Dr. Henry S. Pritchett—" arose out of the action of a joint committee on engineering education, representing the principal engineering societies. More than three years

ago (or about 1914) the committee had gathered a considerable amount of material bearing on the subject, and had come to the opinion that the work could be best carried out by the employment of some one trained in applied science, who should devote his entire attention to the study, working under the general direction of the committee and in touch with it. The Carnegie Foundation agreed to appoint such a man and to bear the expense of the study. Professor Charles R. Mann, of the University of Chicago, undertook the work under these conditions." Such is the prestige of the Mann report that it is still being studied by the heads of engineering schools the world over.

Therefore, if we cannot find in this highly respected bulletin of the Carnegie Foundation some definite idea of the status of English courses in engineering schools, we cannot find it anywhere. Accordingly, the more important points dealing with this division of Dr. Mann's report are quoted in the following extracts:

> With regard to instruction in English, the engineering schools may be divided into two approximately equal groups, the one composed of those schools that maintain the current standard college course; and the other composed of those that are trying to discover a type of work better suited to engineers. In the standard type, of course, the student studies a text-book of composition and rhetoric, learns the rules of correct punctuation and paragraphing, together with the four forms of discourse, and then writes themes on assigned subjects selected by the instructor to give practice in either description, narration, exposition, or argumentation. In some schools the strict adherence to this plan is mitigated [sic] by allowing a choice from among several assigned subjects. The accompanying study of literature consists of a brief survey of the lives of great writers and the analysis of selected passages from their writings. This well-known type, of course, was developed during the latter half of the past century for the purpose of making English an acceptable substitute for the classics in high schools and colleges.
>
> Doubtless because the professional engineers have been so frank in their demand for better training in English, about half of the engineering schools are experimenting with their methods of teaching this subject. These experiments are so varied in plan and execution that it is not possible to classify them. One of the more radical of these is described in Chapter X.

The description thus referred to is as follows:

> Perhaps the most striking experiment with this aim is that now being made by Professor Frank Aydelotte in coöperation with the members of the department of English of the Massachusetts Institute of Technology. At this school English is a required subject for all students throughout

the first two years. The first half of the freshman year is devoted to general composition, with the object of eliminating the more common errors of construction and of leading the student to see that excellence in writing comes not so much from the negative virtue of avoiding errors as from the positive virtue of having something to say.

The work of the second term of the freshman year begins with a class discussion of such questions as: What is the difference between a trade and a profession? What is the meaning of the professional spirit? What should be the position of the engineer in this new era of the manufacture of power—that of hired expert or that of leader and adviser? Is the function of the engineer to direct only the material forces of nature, or also human forces? Such questions readily arouse the interest of engineering students and bring on thoughtful discussion, in which different points of view are expressed by the students and debated with spirit. Essays by engineers are then assigned for reading, and after further discussion each student is asked to write out a statement of his own position on the mooted questions. These themes are criticized in personal conferences in which faults are corrected by asking the writer first what he intended to say; and, second, whether the sentence or phrase in question really says it, rather than by reference to formal rules of grammar and rhetoric. Those who have had experience with this work claim that once the habit of self-criticism from the point of view of the idea is established, the student makes astonishing progress in the ability to express himself clearly and independently; he gathers hints from all sources; and in ways too complex for pedagogical analysis he is more likely to acquire such power over language as he is naturally fitted to possess, than he is by current formal methods. . . . .

Having discussed the question: What is engineering? the class proceeds in the same manner to wrestle with such problems as: What is the aim of engineering education? What is the relation between power of memory and power of thought? Is there any connection between a liberal point of view and capacity for leadership? What qualities do practical engineers value most highly in technical graduates? . . . . What is the relation of science to literature? The authors read in connection with the discussion gradually change from engineers to scientists like Huxley and Tyndall, and then to literary men like Arnold, Newman, Carlyle, and Ruskin. The student seems to read this material with no less keen interest than was shown for the writings of engineers; so that through his own written and oral discussion of masterly essays each comes to work out for himself some rational connection between engineering, with which he began, and literature, with which he ends. No orthodox point of view is prescribed; his own reason is the final authority.

A similar experiment along analogous lines is being made by Professor Karl Young [formerly Professor of English at the Naval Academy] and his colleagues in the department of English at the University of Wisconsin. Reports indicate that this type of course is a great success there also. The materials used in both these courses have been reprinted in book form for the convenience of the classes. [Aydelotte: English and Engineering.

New York: McGraw-Hill, 1917; The Oxford Stamp, Essay X. New York: Oxford Press, 1917; Foerster, Manchester & Young: **Essays for** College Men. New York: Holt, 1913.]

Non-Technical Courses at the Post Graduate School

Before proceeding to explain the bearing of the course in Exposition at the Post Graduate School upon the problems thus discussed in the foregoing review of developments in engineering education, it should be stated that the course in question is to be, if present plans are carried out, one of four non-technical courses, or "half-courses," since perhaps all of them will be scheduled for not more than an hour or two a week, and will extend over not more than four months. In addition to Exposition, there will probably be a course in Methods of Study, one in what may be called the Humanities, not yet definitely planned, and one in Political Economy. The course in Exposition, therefore, should be considered in its relation to three other courses, as well as in terms of a single course.

The Course in Exposition

It is clear that the methods used during the second term at the Massachusetts Institute of Technology, however excellent for that school, are not altogether adapted to the Navy's Post Graduate School. In the first place, the Technology course is for freshmen—whose average age is perhaps between eighteen and nineteen—while the courses at the Post Graduate School, Naval Academy, are for commissioned officers in the Navy—who have been graduated from the Naval Academy at least five years, and who are on the average about twenty-seven years old. Moreover, the post graduate student officers, if they have had not more than the elementary course in English at the Naval Academy, and have been out of touch with English studies for a least five years, are nevertheless men whose experience and whose positions of responsibility place them in a very different category from the students in the first year, or in any year, at the Massachusetts Institute of Technology.

Also, the element of time available for a given course, when we compare the two institutions, brings out another important difference. One the one hand, we are considering a half term which

is but one-fourth of the whole course of two years; on the other hand, we are obliged to deal with a naval post graduate school whose entire course—at Annapolis—lasts but one year, and in that year the course in Exposition is given three times, to three different groups of officers, so that the duration of the course itself is limited to sixteen weeks, with one hour a week, and possibly not more than fourteen hours, all told. In fact, the course must be planned for fourteen hours, with the possibility of short extensions.

All the factors being duly considered, it becomes necessary to organize a course in Exposition which shall be as practical as it can possibly be made, and which shall be adapted as closely as possible to the circumstances and the needs of the post graduate student officers. With the most recent developments of engineering education as the background, and with the well-nigh unique situation at the Post Graduate School in the immediate foreground, what shall be done? It is hoped that officers in the naval service who are interested in the solution of such a problem will offer their suggestions, and criticize the outline of the course herewith presented. It is hoped, further, that once a solution is found, naval officers who desire to increase their proficiency in writing on professional subjects will have a course at hand which they can feel confident will be sound in theory, workable in practice, and the result of naval experience. For if it is well adapted to the requirements of the Post Graduate School, it ought to be, in large measure, adapted to the studying time and the practical requirements of naval officers throughout the service.

Theory of the Course

Each student is assigned a definite, practical objective. This objective is an article on a professional subject, so written as to be acceptable, if not more than acceptable, for publication in the Naval Institute Proceedings, the *Journal of the American Society of Naval Engineers,* or any other magazine devoted to articles on technical subjects, or professional subjects, either primarily or occasionally.

Each student is left free to choose his own subject, provided that he knows enough about it to make more than a minimum of research unnecessary. It is assumed that he is especially inter-

ested in the professional subject chosen, and that the subject is suited in a general way to the purposes of Exposition, as distinguished from Narration or Argument. At the third recitation, however, or one week before the class submits a revision of the first outline of the article, any student has the opportunity to change his subject.

The main work of composition throughout the course is the organization or planning, the writing, and the revision—in several stages—of the article. These successive stages in the composition of the article, though logical in their order, are not continuous. Monotony is avoided, and the student is led to return with more enthusiasm to the writing of the article, by the assignment of intermediate stages of study and practice. Each intermediate stage leads up to the next main task of composition.

Although the course is based upon a similar one given to the post graduate student officers in 1917, it has been revised in the light of experience. Nevertheless, the exaggeration of the mechanical aspect of structure in the Whole Composition and the Paragraph is deliberate, and has been found to be effective.

The first part of the course deals with the Whole Composition—its purpose, organization, convergence, and conclusion. In the very first lesson assignment, the class is directed to submit three statements: (1) The title of the article; (2) The reason for writing the article—a brief explanation of the effect or result desired; (3) The conclusion of the article—that is, a preliminary draft of the final paragraph. This method is similar to the statement of the *Mission* as the first stage in the *Estimate of the Situation,* as conducted at the War College (see Naval War College Pamphlets, Series 1, No. 2: Estimate of the Situation, by Rear Admiral Austin M. Knight, U. S. Navy, published by the U. S. Naval Institute, April, 1915).

Assuming that the course must be planned for not more than fourteen hours, the successive stages of the course, in their order and time allotment, are as follows:

1. The Whole Composition, 4 recitations.
2. The Paragraph, 4 recitations.
3. The Sentence, 3 recitations.
4. The Word, 3 recitations.

If, however, more than fourteen hours should be available, the additional recitations would be devoted to the third stage, The Sentence, and the fourth stage, The Word. If less than fourteen hours should be available, or, for instance, eleven hours, the fourth stage would be omitted and the first three stages would receive the same number of hours, 4, 4, 3. The theory involved is that at least four hours should be spent in organizing the Whole Composition before it becomes worth while to study the division into paragraphs, and the internal structure of the Paragraph; and, likewise, that four hours should be spent in studying and revising paragraphs before it becomes worth while to take up the structure of the Sentence. This does not mean that the structure of sentences and the use of words is less important than the first two stages. It does imply, however, that for the purposes of the course, any stage except the first would be futile without the preceding and preparatory stage.

To classify the four stages, they may be considered as forming two groups, distinctively different, as follows:

Prevision: The Whole Composition and the Paragraph.
Revision: The Sentence and the Word.

This difference is made clearer if we compare it with the difference between Strategy and Tactics, by saying that Prevision in Composition corresponds to Strategy in War, and that revision corresponds to Tactics in battle. In other words, the Whole Composition and the Paragraph can be planned in advance, while the Sentence and the Word should be handled spontaneously in actual writing, at first, and afterward subjected to careful revision. "For," says Barrett Wendell, a notable master of the art of teaching composition, "there is no fact in human experience more settled than this: to do anything thoroughly well we must not stop in the act to consider how we are doing it. Action of any kind may and should be carefully planned; things once done may be and should be rigorously scrutinized. But the time to plan is before work begins; the time to criticize is after the work is done."

By the study of the Whole Composition and the Paragraph, then, the students acquire a "doctrine," or are "indoctrinated" in the principles of composition and Exposition. While it may also be said that they are indoctrinated in the principles of structure

of the Sentence, and in the use and choice of Words, they can continue the practice of writing sentences and words the rest of their lives, whereas they are not apt to study the principles of planning the whole composition and the paragraph except in a course such as the one in question, under the guidance and criticism of an instructor.

The recitation hour is divided into two parts: (1) a lecture, of thirty minutes or less; (2) a test or tests, lasting thirty minutes or more. In this way, the university lecture method is combined with the Naval Academy recitation method.

Constant use is made of mimeograph notes, not only for the sake of definiteness in instruction, but in order that the students may keep the notes permanently in their possession for future use. Indeed, the value of modern mimeographing in education has not been fully recognized. It increases to an extraordinary degree the efficiency of both teaching and learning, and enables the class to cover much more ground than they could otherwise cover in a given time. The nature of the mimeograph notes used in the course in Exposition is in general as follows: Lesson schedules, issued a few days in advance of the recitation; notes on structure, with concrete examples for illustration; outlines of all lectures, given out after the lecture; folded sheets, with test questions on one side and answers to questions on the reverse side.

In correcting the first draft of the article (handed in at the sixth hour), attention is paid solely to the division into paragraphs, and transitions between paragraphs. The second draft, in which the student is concerned mainly with the internal structure of each paragraph, is corrected exclusively for such structure. The third and the fourth drafts, each one being a revision of half of the article for sentence structure, are corrected for sentence structure only. The final draft, submitted at the last hour of the course, is written and corrected with regard, exclusively, to the use of words, their selection, their number, and their combinations or phrasing.

Serious errors of form are corrected throughout the course, but these corrections are made in blue pencil, to distinguish them from rhetorical corrections, made in red pencil. This apparently trivial detail is intended to make clear the fact that corrections of form (spelling, grammar, punctuation) are decidedly less important than rhetorical corrections. The class is told that

corrections of form are subsidiary to rhetorical criticism, that the former will be reduced to a minimum, and that the marks assigned will be based almost entirely upon the proficiency with which the students apply the larger principles.

The three textbooks upon which the lesson assignments are based are used mainly as material for exercises and examples, both in preparation, and during the recitation hour. They are very different in purpose, and are combined to give the class a broader point of view than any one textbook could offer. Of the three books, the one most frequently used, because it consists mainly of examples of Exposition, is Fulton's *Expository Writing*, (the MacMillan Company, 1912). The others are Stevens and Alden's *Composition for Naval Officers* (the Lord Baltimore Press, 1919), and Woolley's *The Mechanics of Writing* (D. C. Heath & Company, 1916).

Although lack of space forbids a description of the lessons, lectures, and tests in detail, a list of the lecture subjects and of the authors whose writings are studied in Fulton's text-book will give a general idea of the methods used.

TITLES OF LECTURES

1. Unity: Limitation and Convergence; the Conclusion.
2. Coherence: Order and Sequence; Transitions.
3. Clearness: Proportion and Emphasis; Subheadings.
4. Interest: Concreteness: Comparison; Illustration.
5. What Is a Paragraph?
6. Similarities in Structure between the Whole Composition and the Paragraph.
7. The Paragraph as a Mechanism.
8. Deductive and Inductive Paragraphs.
9. The Pre-Determination of Sentences: Parallel Construction and Transition.
10. Similarities in Structure between the Paragraph and the Sentence.
11. The Sentence as the Focus of Structural Principles.
12. The Principles of Word Choice.
13. Accuracy in Words: The Bearing of Etymology on Accuracy.
14. Good Use and Vocabulary: The Habit of Word Criticism and Word Observation.

Of the examples of Exposition studied and analyzed, the following are characteristic:

A selected article in the NAVAL INSTITUTE PROCEEDINGS.
What Is Education? Huxley.
Refining Crude Petroleum. Tower. (*The Story of Oil.*)
The Importance of Dust. Wallace. (*The Wonderful Century.*)
On Yeast. Huxley.
Americanism: An Attempt at a Definition. Brander Matthews. (*Parts of Speech.*)
The Relativity of All Knowledge. Spencer. (*First Principles.*)
The Ideal Historian. Macaulay. (*Essay on History.*)
Literature. Cardinal Newman. (*The Idea of a University.*)
The Chemist in the Industries. Richardson.
The Web-foot Engineer. Brooks.
Two Kinds of Education for Engineers. Johnson.
Racial Elements of English Character. Matthew Arnold. (*On the Study of Celtic Literature.*)
The Value of Education in Science. Mill. (*Discussions and Dissertations.*)
Equality. James Bryce.
The Rhythm of Motion. Spencer. (*First Principles.*)
Modern Chemistry and Medicine. Richards.
The Problems of Astronomy. Newcomb.
Stephen B. Luce: An Appreciation. Rear Admiral Bradley A. Fiske, U. S. Navy, (reprinted by permission from the Naval Institute).
The British Navy at the Time of the American Revolution. Rear Admiral French Ensor Chadwick, U. S. Navy, (abridged from the Introduction to *The Graves Papers, and Other Documents Relating to the Naval Operations of the Yorktown Campaign.* Reprinted by permission of the Naval History Society).

For variety, and more informal illustration of principles, certain reference books are in addition placed at the disposal of the class. Among these are:

Sea Warfare. Rudyard Kipling.
Elements of the Great War: The Battle of the Marne. Hilaire Belloc.

The Grand Fleet, 1914-1916, Its Creation, Development, and Work. Admiral Viscount Jellicoe of Scapa.

Copies of recent numbers of *The World's Work*.

The Ship That Found Herself, Steam Tactics, A Fleet in Being, etc. Kipling.

In conclusion, the following reproduction of the folded mimeograph sheet used for the test during the first hour of the course will indicate the nature of the tests assigned:

UNITED STATES NAVAL ACADEMY POST GRADUATE DEPARTMENT

COURSE IN EXPOSITION

THE WHOLE COMPOSITION—I TOPIC CARD TEST

1. Each student is given a shuffled pack of cards. The pack contains 20 cards, and each card contains a topic sentence taken from an article in the NAVAL INSTITUTE PROCEEDINGS for March, 1919, entitled:
"SOME IDEAS ABOUT THE EFFECTS OF INCREASING THE SIZE OF BATTLESHIPS"

2. The article in question contains 79 paragraphs. These paragraphs are grouped under six main divisions or main headings, including the Foreword and the Conclusion. There are thus six main topics and seventy-nine sub-topics, or eighty-five topics in all. As the majority of the paragraphs are very short, and deal with minor details, the selection of twenty topics for this test is sufficient to give a clear idea of the outline of the article. The topic sentences representing the six main divisions are included in the pack of cards.

3. *Problem.*—(1) Arrange the cards in logical order. Time allowed: fifteen minutes. (2) Select the six cards which you think represent the six main topics of the article (1. Foreword; 2. First Main Topic; 3. Second Main Topic; 4. Third Main Topic; 5. Fourth Main Topic; 6. Conclusion). Write these six main topics down in outline form on theme paper. Time allowed: ten minutes. (3) Compare your outline with the key on the folded side of this paper.

........................(Fold on this line)........................

KEY TO TOPIC CARD TEST

Full Outline for Cards

I. Foreword: Shipbuilding . . . . is a matter of continuous progress.

II. The Qualities of Naval Ships . . . .

1. Useful displacement is apportioned according to intended service.
2. The total displacement . . . . is made up of the following . . . .

III. Battleships Considered Singly . . . .

1. Armament.
2. Protection.
3. Mobility . . . . (Of all the qualities which a battleship should have, none is more disputed than that part of mobility which speed supplies.)
4. Endurance.

IV. Probable Limits of the Size of Battleships.

1. The locks of the Panama Canal . . . . should take a ship 980 feet long and 110-foot beam.

V. Numerous Battleships Considered Together.

1. Coördination of available forces is employed in two principal ways, *i. e.*, strategy and tactics.
2. The tactical considerations involved . . . .
3. Considerations of strategy . . . .
4. Certain economic considerations . . . .

VI. Conclusion:

1. Summary: The battleship of increased size, considered singly, can carry more fighting power, be protected for more effective resistance, have higher speed under all conditions, greater radius of action, and greater cruising life.

   Battleships of increased size, considered together, are of greater tactical value, of greater strategic value, and of greater economic value.
2. The decision is definitely in favor of the battleship of increased size.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE IDENTIFICATION OF STARS IN CLOUDY WEATHER

By Captain Armistead Rust, U. S. Navy

1. An unknown star may be readily identified by means of the Star Identification Tables (H. O. Publication No. 127) when its altitude and azimuth have been observed. In cloudy weather, however, at night, when there is much motion on the ship and particularly when the altitude of the star is high, it is not convenient to obtain a compass bearing of the star.

For the purpose of star identification the azimuth may be obtained, without the use of the compass, from two observed altitudes as shown below.

From formula 285 of Chauvenet's Trigonometry (10th edition), we have:

$$\Delta h = \cos Z \Delta L + \cos M \Delta d - \cos L \sin Z \Delta t. \qquad (1)$$

Let L and d be constant, then:

$$\Delta h = -\cos L \sin Z \Delta t. \qquad (2)$$

If $\Delta t = 1$ minute of time $= 15'$ of arc, we have:
Rate of change of altitude in 1 minute,

$$\Delta h_1 = R_m = -\cos L \sin Z, \qquad (3)$$

hence,

$$\sin Z = -\frac{R_m}{15} \sec L. \qquad (4)$$

R_m may be found from the difference between two altitudes, observed in quick succession, expressed in minutes and decimals, divided by the interval between the observations in minutes and decimals of time. To be exact, unless the ship be on a course at right angles to the bearing of the body, the rate of change of altitude in one minute, R_m, found by observation must be corrected for the run of the ship; that is, if K minutes is the speed of the ship per hour, then K seconds is the speed per minute and the correction $= K'' \cos (C \sim Z)$, where $C =$ course and $Z =$ azimuth of the body, which is found by using the observed rate of change per minute and Plate I. Enter the Traverse Tables with K'' as

a distance and $(C \sim Z)$ as a course, then the correction is fou as a difference of latitude, to be subtracted from the o served change of altitude per minute when the ship is movi towards the body, and to be added when moving away from t body; in other words, when $(C \sim Z)$ is less than 90°, subtra when $(C \sim Z)$ is greater than 90°, enter with the supplement $(C \sim Z)$ and add the correction. The above rules apply when t body is rising; when falling, add when approaching, and subtra when separating. As a rule, this correction is not necessary f finding the approximate azimuth for the identification of sta except in very fast ships whose courses are nearly towards away from the observed body.

After finding R_m find the azimuth from Plate I by taking on a vertical scale, the intersection of the horizontal line throu this point with the curve corresponding to the latitude of the sh fixes a vertical line which determines the azimuth at the bottom top of the diagram, depending upon the compass quadrant in whi the body lies, and this should be noted roughly at the time t altitudes are observed. The enlarged part of Plate I is for al tudes near the meridian.

2. To find the hour angle of the star from Table I:

TABLE I.—FOR FINDING THE HOUR ANGLE

GIVEN THE ALTITUDE AND AZIMUTH OF THE STAR AND THE LATITUDE OF THE OBS

A		2°	3°	7°	18°	19°	32°	58°	71°	72°	83°	87°	88°
°	D	1	2	4	12	13	24	60	109	115	298	669	969
37	79	......	0.1223	......	......	......	......	......	......	......	......	......	......
	110	......	......	......	......	......	......	0.1193	......	......	......	......	......
37	79	......	......	......	......	......	......	......	......	......	......	8.8022	......
	514	......	......	......	......	......	8.8010	.....	......	......	......	......	......
55	81	9.8448	......	......	......	......	......	......	......	......	......	......	......
	104	......	......	......	......	......	......	......	......	9.8414	......	......	......
55	81	......	......	......	......	......	......	......	......	......	......	......	8.3880
	1250	......	......	......	8.3963	......	......	......	......	......	......	......	......
57½	83	......	......	9.8011	......	......	......	......	......	......	......	......	......
	94	......	......	......	......	......	......	......	9.8011	......	......	......	......
57½	83	......	......	......	......	......	......	......	......	......	8.8901	......	......
	460	......	......	......	......	8.8907	......	......	......	......	......	......	......

NOTE.—In the complete table the angles in columns A and B, and in the headline are given for every ½°; the logarithmic differences are given in column D and head DD′, so that interpolation may be made for the odd minutes with ease when extre accuracy is required. For identifying stars this is not necessary.

Table I was computed with a view to having a compact Time-Azimuth Table for all latitudes and declinations and for finding the great circle courses when the distance is not known, as well as for finding the hour angle in star identification; in other words, it was designed to solve the following equations:

$$\text{Cot } \tfrac{1}{2}t \cos \tfrac{1}{2}(L\sim d)=\cos \{90^\circ-\tfrac{1}{2}(L+d)\} \tan \tfrac{1}{2}(Z+M). \quad (5)$$

$$\text{Cot } \tfrac{1}{2}t \cos \{90^\circ-\tfrac{1}{2}(L\sim d)\}=\cos \tfrac{1}{2}(L+d) \tan \tfrac{1}{2}(Z\sim M). \quad (6)$$

$$\text{Cot } \tfrac{1}{2}\lambda \cos \tfrac{1}{2}(L_1\sim L_2)=\cos \{90^\circ-\tfrac{1}{2}(L_1+L_2)\} \tan \tfrac{1}{2}(C_1+C_2). \quad (7)$$

$$\text{Cot } \tfrac{1}{2}\lambda \cos \{90^\circ-\tfrac{1}{2}(L_1\sim L_2)\}=\cos \tfrac{1}{2}(L_1+L_2) \tan \tfrac{1}{2}(C_1\sim C_2). \quad (8)$$

$$\text{Cot } \tfrac{1}{2}Z \cos \tfrac{1}{2}(L\sim h)=\cos \{90^\circ-\tfrac{1}{2}(L+h)\} \tan \tfrac{1}{2}(t+M). \quad (9)$$

$$\text{Cot } \tfrac{1}{2}Z \cos \{90^\circ-\tfrac{1}{2}(L\sim h)\}=\cos \tfrac{1}{2}(L+h) \tan \tfrac{1}{2}(t\sim M). \quad (10)$$

Here we are concerned with formulas (9) and (10) only, and the altitude, h, is always given the same name as the latitude, L.

To find the hour angle, given the true altitude and azimuth of the star, from the elevated pole, and the latitude of the observer.

Enter Table I with $\tfrac{1}{2}Z$ in column A, and opposite $\tfrac{1}{2}Z$ and under $\tfrac{1}{2}(L\sim h$ in the headline AB take out log X; under $90^\circ-\tfrac{1}{2}(L\sim h)$ in the headline AB find this log X, and take out the angle X opposite in column B.

Opposite $\tfrac{1}{2}Z$ in column A and under $90^\circ-\tfrac{1}{2}(L-h)$ in the headline AB take out log Y; under $\tfrac{1}{2}(L+h)$ in headline AB find log Y and the corresponding angle, Y, opposite in column B.

Then, when $L>h$ we have, $t=X+Y$, and when $L<h$ we have, $t=X-Y$.

HOUR ANGLE FROM AZIMUTH TABLES

3. As Table I contains about 36 pages it is too long to reproduce here, nor is it necessary for the purposes of this paper, as the Azimuth Tables may also be used for finding the hour angle of a star when its altitude and azimuth are given when the Star Identification Tables are not available. Table I is shown in skeleton form to indicate its use.

To find the hour angle:

Enter the Azimuth Tables in the latitude of the ship with the azimuth as an hour angle and the altitude as a declination; the corresponding azimuth is the hour angle of the star.

In order to find the hour angle from the Azimuth Tables it is necessary to first determine the name of the declination, which may

be readily done from Table II, for which the writer is indebted to Commander H. L. Rice, Professor of Mathematics, U. S. Navy.

TABLE II—VALUES OF *Q*

Altitudes	For azimuths North toward West or North toward East										Altitudes
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	
°	°	°	°	°	°	°	°	°	°	°	°
10	16.0	16.0	15.9	15.7	15.4	14.9	14.1	12.5	8.9	0.0	10
20	14.0	13.9	13.8	13.4	12.9	12.1	10.8	8.6	5.1	0.0	20
30	12.0	11.9	11.7	11.3	10.6	9.6	8.2	6.1	3.3	0.0	30
40	10.0	9.9	9.6	9.2	8.5	7.5	6.2	4.4	2.3	0.0	40
50	8.0	7.9	7.7	7.2	6.5	5.7	4.6	3.2	1.7	0.0	50
60	6.0	5.9	5.7	5.3	4.8	4.1	3.2	2.2	1.1	0.0	60
70	n4.0	3.9	3.8	3.5	3.1	2.6	2.1	1.4	0.7	0.0	70
80	2.0	2.0	1.9	1.7	1.5	1.3	1.0	0.7	0.4	0.0	80
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90
Altitudes	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	Altitudes
	For azimuths South toward West or South toward East										

Express the latitude in degrees and tenths as *Q* in the table.
Mark North latitude + and South latitude —.
When the azimuth is found at the top of the table, *Q* is +.
When the azimuth is found at the bottom of the table, *Q* is —.
The declination has the sign of $Q + \frac{\text{latitude}}{\cdot 5}$.

TO FIND THE DECLINATION

4. After finding the hour angle the declination is readily found from Plate II by entering with the azimuth on a vertical margin; the intersection of the horizontal line through this point with the altitude curve of the body, numbered at the top of the diagram, fixes a vertical line, the intersection of which with the horizontal line through the hour angle, taken on a vertical scale, determines the declination of the body, which is marked N. or S., as shown by Table II.

From the local sidereal time subtract the hour angle when West, or add it when East, the result is the right ascension of the star, so that having both the right ascension and the declination the star can be found with certainty in the star list.

Example 1.—At sea, August 10, 1904, in Lat. 11°37′ N., Long. 81°09′ W., about 5.30 a. m., observed two altitudes of a bright star

through a rift in the clouds, bearing to the S'd and E'd, altitude cor.—9'; G. S. T. of 2d observation $8^h 12^m 17^s$.

As the ship was rolling heavily at the time no accurate bearing could be taken. What star was observed?

	Watch times		Obs. altitudes
	$5^h 33^m 23^s$		$25° 33'$
	5 35 43		26 04
Interval	2 20	Diff.	31

$31' \div 2\frac{1}{3} = 13.3' = R_m$. From Plate I, $Z = $ N. $115°$ E.

$$X \begin{cases} \text{(a)} & \frac{1}{2}Z = 57°30'. \\ \text{(b)} & \frac{1}{2}(h-L) = 7°09'. \\ \text{(c)} & 90° - \frac{1}{2}(L+h) = 71°14'. \end{cases}$$

. . . .

$$Y \begin{cases} \text{(a)} & \frac{1}{2}Z = 57°30'. \\ \text{(d)} & 90° - \frac{1}{2}(h-L) = 82°51'. \\ \text{(e)} & \frac{1}{2}(L+h) = 18°46'. \end{cases}$$

Proceed as directed in paragraph 2 and we find: Log $X = 9.8011$, and $X = 63°$. Also, log $Y = 8.8901$, and $Y = 4°42'$.

As $L < h$, then $t < M$ and $t = X - Y = 58°18' = 3^h 53^m 12^s$.

Note that in the groups for finding X and Y, (a) is the same in both, and (d) and (e) are the complements of (b) and (c) respectively.

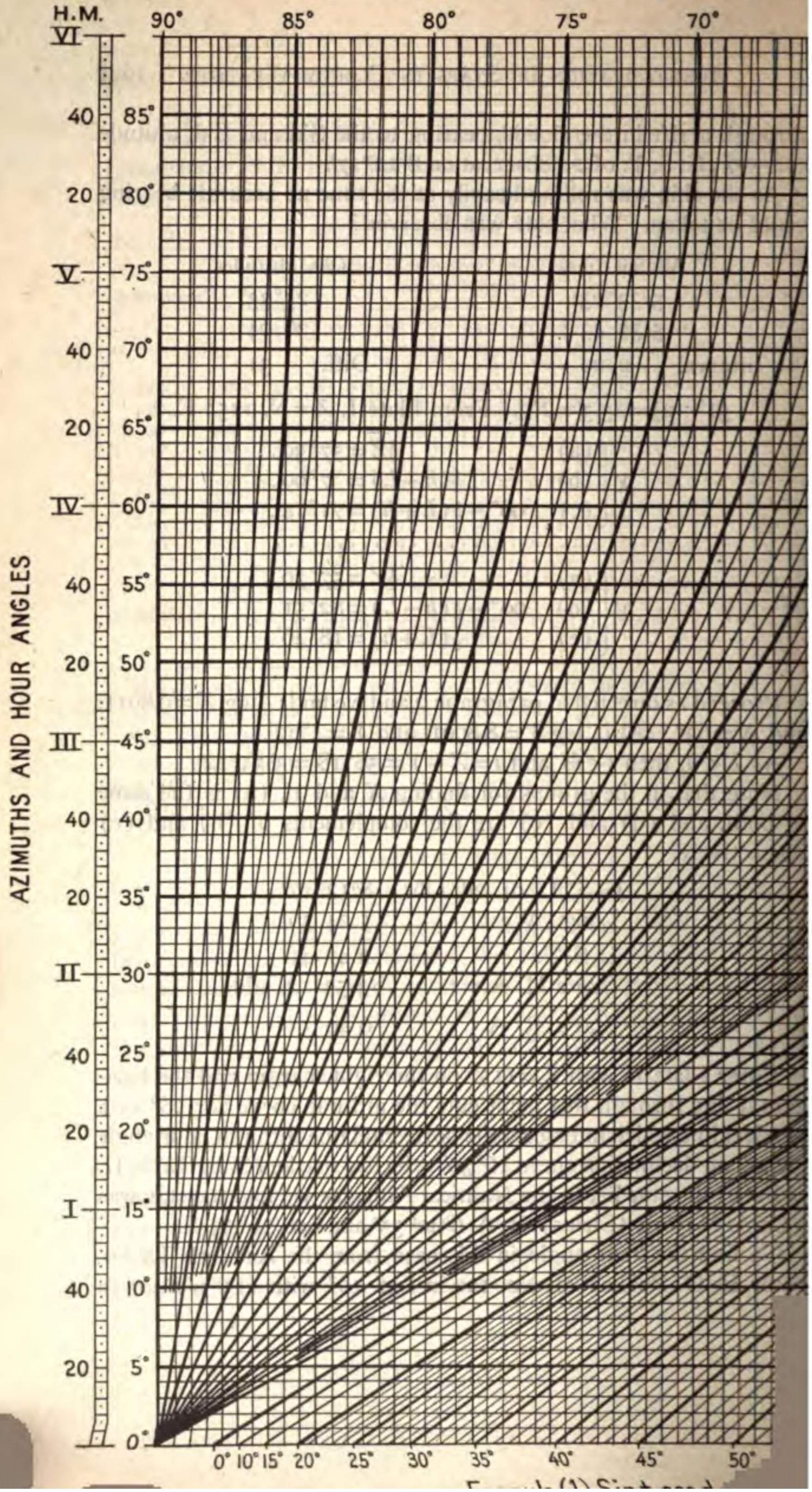
G. S. T. of 2d Obs.	$8^h 12^m 17^s$
Long., West	5 24 36
L. S. T.	2 47 41
Star's H. A. $= t$	3 53 12, add.
Star's R. A.	6 40 53

Enter Plate II with $Z = 115°$ on the right margin and the horizontal line through this point cuts the altitude curve for $26°$ in a vertical line which intersects the horizontal line through hour angle $58°18'$ on declination curve $16°30'$, which is marked S. by Table II.

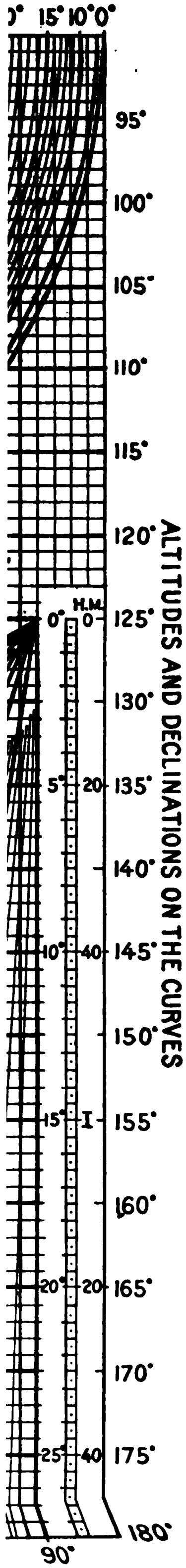
From the star list in the Nautical Almanac we find the star was α Canis Majoris (Sirius), R. A. $6^h 40^m 55^s$ and dec. $16°35'$ S.

To find the hour angle in this case from the Azimuth Tables, enter H. O. Publication No. 120 in Lat. $12°$ with $115° = 7^h 40^m$ in

RUST'S AZIMUTH, STAR-



LATE II.


15° 10° 0°
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
145°
150°
155°
160°
165°
170°
175°
180°
ALTITUDES AND DECLINATIONS ON THE CURVES
H.M.
0°
5°
10°
15°
20°
25°
0
20
40
I
20
40
90°

the hour angle column, and in the 26° declination column we find $58°04' = 3^h 52^m 16^s$ for the hour angle of the star.

Example 2.—At sea, February 26, 1901, 6.30 p. m., L. M. T., weather overcast and cloudy; the altitude of an unknown star of about the 2d magnitude, seen through a break in the clouds, was 29°30′ (true), bearing N. 74° W. Lat. by D. R. 35° N., Long. 60° W. What was the name of the star?

$$X\begin{cases} \text{(a)} & \tfrac{1}{2}Z = 37°. \\ \text{(b)} & \tfrac{1}{2}(L-h) = 2°45'. \\ \text{(c)} & 90° - \tfrac{1}{2}(L+h) = 57°45'. \end{cases}$$

. . . .

$$Y\begin{cases} \text{(a)} & \tfrac{1}{2}Z = 37° \\ \text{(d)} & 90° - \tfrac{1}{2}(L-h) = 87°15'. \\ \text{(e)} & \tfrac{1}{2}(L+h) = 32°15'. \end{cases}$$

From Table I, we have: Log $X = 0.1223$, and $X = 68°$. Also, log $Y = 8.8022$, and $Y = 4°18'$.

As $L > h$, $t =$ H. A. $= X + Y$; hence, H. A. $= 72°18' = 4^h 49^m 12^s$.

L. M. T.	$6^h 30^m 00^s$
R. A. M. S.	22 22 33
Cor. G. M. T.	1 43
L. S. T.	4 54 16
Star's H. A.	4 49 12 (West)
Star's R. A.	0 05 04

Enter Plate II with $Z = 74°$ on the left margin, the horizontal line through this point cuts the altitude curve for 29°30′ in a vertical line which intersects the horizontal line through the hour angle, 72°18′, on the curve for 28°30′, the declination of the star, which is North by Table II. The star is α Andromedæ, R. A. $0^h 03^m 19^s$, dec. 28°33′ N.

The numbers at the top and bottom of Plate II mark the curves. These are altitude curves when the azimuth is taken on the margin and declination curves when the hour angle is considered on the margin.

To find the hour angle from the Azimuth Tables, $74° = 4^h 56^m$. Enter H. O. Publication No. 120 in Lat. 35° with $4^h 56^m$ as an hour angle, and the altitude, 29°30′, as a declination we find, $Z = 72°24' = 4^h 49^m 36^s$—the required hour angle.

Example 3.—At sea, February 6, 1903, Lat. 16° S., Long. 38° 12′ W., observed the following altitudes of a star to the N'd and W'd. Cloudy weather with a heavy sea so that no accurate bearing could be taken by compass. What star was observed? Ans. α Leonis.

Obs. alts.	W. t.	
20° 18′	$5^h 05^m 07^s$	C—W = $3^h 08^m 13^s$
19 39	5 08 00	Chro. fast of G. M. T., $0^h 20^m 13^s$
		Altitude correction, $-7'$.

In $2^m 53^s$ change in altitude = 39′ and $R_m = 13.52'$, and from Plate I Z = S. 110° 30′ W.

$$X\begin{cases}\text{(a)} & \tfrac{1}{2}Z = 55^\circ 15'.\\ \text{(b)} & \tfrac{1}{2}(h-L) = 2^\circ.\\ \text{(c)} & 90^\circ - \tfrac{1}{2}(L+h) = 72^\circ.\end{cases}$$

. . . .

$$Y\begin{cases}\text{(a)} & \tfrac{1}{2}Z = 55^\circ 15'.\\ \text{(d)} & 90^\circ - \tfrac{1}{2}(h-L) = 88^\circ.\\ \text{(e)} & \tfrac{1}{2}(L+h) = 18^\circ.\end{cases}$$

From Table I: Log $X = 9.8448$ and $X = 66°$. Log Y = 8.3880 and Y = 1° 30′.

As $L < h$ then $t = X - Y = 64° 30′$, or hour angle = $4^h 18^m$.

From Plate II with $Z = 110° 30′$, $h = 20°$ and hour angle 64° 30′, we find the declination, 12° 30′, marked North by Table II.

w. t. (mean)	$5^h 06^m 33^s$
C−W	3 08 13
Chro.	8 14 46
Chro. cor.	− 20 09
G. M. T., Feb. 5	19 54 37
R. A. M. S.	20 57 50
Cor. G. M. T.	3 16
G. S. T.	16 55 43
Long., West	2 32 48
L. S. T.	14 22 55
Star's H. A.	4 18 00
Star's R. A.	10 04 55

To find the hour angle from the Azimuth Tables, enter H. O. Publication No. 71, Lat 16°, dec. 20°, contrary name. We find

that the hour angle, $7^h22^m = 110°30'$, is not given, so we enter with the supplement of this hour angle, 4^h38^m and the supplement of the corresponding azimuth, $115°30'$, or $64°30' = 4^h18^m$, is the hour angle required.

The right ascension and declination here found correspond to α Leonis (Regulus).

After finding the hour angle and declination enter the Azimuth Tables with these to see whether the azimuth so found agrees with that given, thus verifying the work.

5. When the star is on or very near the meridian, so that its hour angle is practically 0, the star's right ascension may be assumed equal to the local sidereal time and its declination may be readily found by applying its zenith distance to the latitude by dead reckoning.

6. The writer has found Plate II very convenient for finding the altitude at which to set the sextant in order to pick up a particular star in the early evening twilight, or to find Venus or Jupiter by day.

From the local apparent time, at which it is desired take the observation, find the local sidereal time, to which apply the star's right ascension to obtain its hour angle and take its azimuth from the tables.

Enter Plate II with the hour angle on the margin; the intersection of the horizontal line through this point with the declination curve of the body fixes a vertical line, the intersection of which with the horizontal line through the given azimuth determines the altitude curve of the star.

Example 4.—In the early evening twilight, at sea, February 26, 1901, Lat. 35° N., Long. 60° W., what was the altitude of α Andromedæ at 6.30 p. m., L. M. T., when the star's hour angle was $4^h49^m12^s$ and its azimuth N. 74° W.? Star's declination 28°30′ N.

From Plate II the altitude was 29°30′. Set the sextant to this altitude and at the proper time by watch sweep the horizon over the pelorus set at N. 74° W. Thus the reflected image of the star may be easily seen on the horizon long before the eye can catch the direct image in the sky.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

FUELING AT SEA

By COMMANDER H. C. DINGER, U. S. Navy

In time of war the question of fuel supply for patrol, convoy, and scouting vessels, and for all men of war operating on extensive overseas operations becomes most important. It is unhandy, dangerous, and sometimes impossible to go to a port to refuel, and, therefore, the problem of fueling at sea requires a solution. In smooth water, the problem of taking on board either coal or oil becomes quite simple, but it is at times undesirable to stop the vessels en route, and a dead calm is not always at hand. What is desired is to fuel vessels while underway at fair speed in an ordinary swell or seaway. This can and has been done.

In a dead smooth sea, the vessels can be taken alongside and tied up much the same as in port, but if there is any swell or seaway, this is dangerous. To accomplish the transfer of fuel in anything but a smooth sea, one of the vessels must be towed.

Numerous experiments have been made with special coaling at sea gears, in which the vessel taking the coal is towed by the fuel vessel, and the coal is carried by a special cableway, from the stern of the collier to the forecastle of the vessel. These installations require a great deal of special gear, and require a long space of time to rig, and the rate of delivery is so slow that this system is impractical, and is not used in actual practice. The files of the PROCEEDINGS of the Naval Institute contain several accounts of such coaling-at-sea experiments. In general, the transfer of fuel by towing astern has not been a practical success. There is an alternative method, towing abreast, which has much greater promise of success, and requires little or no extra gear on the fuel vessel, and no extra gear or attachments on the vessel receiving the fuel.

It is a comparatively easy operation to take a vessel in tow abreast and maintain her position—a steady almost exact posi-

tion—well clear of the side. With a vessel maintained in this position, coal can be transferred by bags from boom ends, or by means of movable pipes from fuel vessels fitted with coaling towers. A coaling tower is a device operating a self-filling bucket chain, or coal elevator. The coal being dumped at the top of the tower into a hopper, from which coal pipes are led to the point where coal is to be landed. These devices have been used successfully for years on coal barges, and for unloading ore, sulphur, etc. The bucket chain is adjustable, and end can be lowered as necessary into the hold. The coaling tower can be mounted on tracks, so as to be capable of being moved to any point of the coal hold. Designs of these towers have been prepared, which are adaptable to naval colliers. Two or three of such towers, each operated by an electric motor, would replace all the elaborate winch, bucket and derrick gear now fitted to our naval colliers; and would be a big improvement in cost of operation as well as safety.

With these coaling towers, coaling might be accomplished through flexible tubing, which would be almost the same thing as coaling through a hose.

As far as is known, the first actual oiling of vessels at sea in rough weather was done by the U. S. S. *Maumee* in May, 1917, when a division of destroyers was oiled on the way across the Atlantic.

The gear used was as follows:

A 10-inch manila line was led from the bow of the fuel vessel, taken outboard and stopped along the rail; a 2-inch messenger was bent on the end. Two 6-inch breast lines were provided with heaving lines. Two 3-inch lines of oil hose were connected to the oil line, and were supported on a wooden carrier suspended from boom end, the line supporting this carrier being led to a winch, and tended by winch man.

The manner of coming alongside, taking lines, etc., is indicated in the instructions prepared for the occasion, quoted as follows:

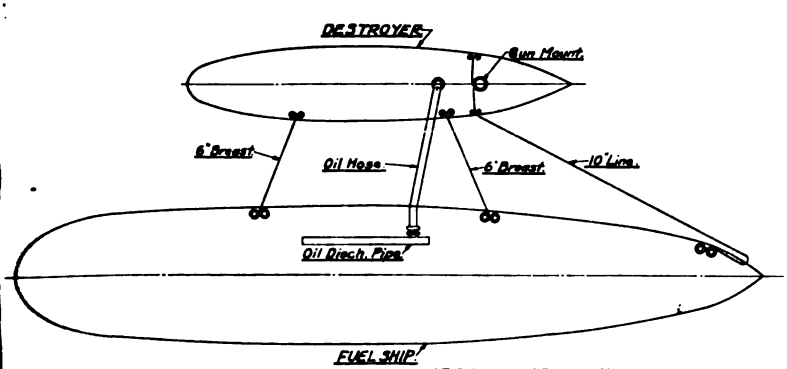
PREPARED ON U. S. S. "MAUMEE" FOR GUIDANCE OF DESTROYERS OILING AT SEA

1. *Gear.*—All supplied by fuel ship.

10-Inch Bow Spring.—This line is led from the bow of the fuel ship and stopped along the rail; a 2-inch messenger is bent on about 50 feet from

end and stopped along to end. This line should be taken in on destroyer bow through bitts just forward of bridge. Take messenger to capstan and assist handling by hand; cut stops as they come to bitts. Take turn around base of gun mount as indicated on sketch and secure end to bitts on opposite side. Be sure that hawser is secure around base so that it will not ride up on mount. As soon as end is secured notify fuel ship, which will then heave in to place destroyer in proper position. Put lashings around and over bitts to prevent hawser jumping.

2. *Breast Lines, 6-Inch.*—Forward, take in through bitts forward of forward gun, then to bitts forward of capstan. Do not secure to capstan as it may be damaged. This line *must* be securely fastened as a very heavy strain may come on it.



ARRANGEMENT OF LINES AND OIL HOSE FOR OILING DESTROYERS AT SEA.

3. *After Line.*—Take through bitts in wake of deck house, secure, and stand by to tend.

4. *Hose.*—The hose, two lines, are led together through a wooden carrier supported from boom. Near end of hose, there is a wooden yoke to which is attached a handling line. The hose should be handled on board destroyer with this line, not with end of hose. Rail should be broken down and clear where hose is taken on board. Get ends of hose and hose yoke on destroyer, secure yoke and then put ends of hose in tanks. Pumping will start as soon as destroyer reports ready.

5. *Handling of Destroyer.*—Come along on parallel course, speed about 8 knots, distance about 50 feet from fuel ship; slow down to keep abreast fuel ship, ease in or out as necessary, but do not drop aft too far and get under counter. When 10-inch spring is fast, drop down on it slightly and let fuel vessel take in on breast lines till desired position is reached, about

40 feet from side, then maintain about 4 knots, just keeping slight or occasional strain on 10-inch spring. Destroyer will then ride to 10-inch spring and forward breast. Do not head out suddenly as this will break away the forward breast. Speed up if necessary to take strain off 10-inch spring and keep from swinging in too close.

The breast lines keep the destroyer in and prevent hose being carried away. Destroyers can come abreast and make connections in moderate sea without danger if precautions mentioned are adhered to. The principal danger is coming too close and throwing stern in. There is a suction under counter and destroyer should keep out of this. A speed of about 5 knots is maintained by fuel ship. This is necessary in order to steady fuel vessel and enable her to steer a straight course. The fuel vessel must

DESTROYER COMING ALONGSIDE.

steer a straight course; rolling is not objectionable, but yawing is,—hence sea should be abeam or slightly forward of beam.

6. Before coming alongside destroyer should have her forecastle clear, rail clear for hose, have lashings ready, capstan ready and men instructed where the lines are to be led. Lines must be *very* securely fastened.

In smooth weather one destroyer can be taken on each side, and in calm, destroyers can make fast and receive oil as in port.

The first time that this was tried was in a moderate sea, as the attached photograph will indicate. The destroyers were each oiled in about two hours, and oil was delivered at from 30,000 to 40,000 gallons an hour. In some cases destroyers were connected up and oil being pumped on board in 15 minutes from the time the destroyer passed the stern of fuel vessel, this being done with a

DESTROYER OILING, VIEW FROM DECK OF FUEL VESSEL.

STROYER ALONGSIDE OILING—VIEW FROM BRIDGE OF FUEL VESSEL.

vessel that had never previously gone through the operation. With practice, a destroyer could no doubt connect up in 10 minutes.

In rough sea the fuel vessel makes a lea, taking sea a little forward of beam. In smooth weather a destroyer can be taken on each side while steaming 8 to 10 knots, one vessel connecting up while the other is having oil delivered. When towing abreast, both vessels are entirely and instantly under full control of their engines and helm. Lines can be cast adrift without danger of fouling screws. The whole operation can be viewed by the captain from the bridge of each vessel, and the two vessels are in direct verbal communication *all* of the time that they are close to each other. In towing astern or from the quarter, this is not the case, and unless the officer in control of either vessel can see fully what the other is doing, difficulties are likely to be presented.

With fuel vessels thus arranged as mentioned above, a fleet can maintain the sea indefinitely. Fueling cannot be attempted in very rough weather, but a fairly smooth sea can usually be found in the course of several days, except in specially tempestuous waters.

The method employed with destroyers can be used for much larger vessels, though perhaps it could not be done in as rough a sea.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Change in Board of Control

Captain David Potter PC., U. S. Navy, tendered his resignation as a member of the Board of Control, and his resignation was accepted by the Board with regret on August 12, 1919.

Membership

Life, regular and associate membership, 5652. New members: 7. Resignations: 27. Dropped: 9. Deaths: (15)

Lieut. Commander R. O. Baush, U. S. N.
Lieut. Commander Richard M. Elliot, U. S. N.
Lieut. F. D. Blakely, U. S. N.
Midshipman R. G. Campbell, Jr., U. S. N.
Lieut. T. T. Bower, U. S. N.
Ensign S. S. Cutler, U. S. N.
Lieut. J. S. Spaven, U. S. N.
Lieut. J. W. Gale, U. S. N. R. F.
Ensign W. E. Bingham, U. S. N. R. F.
Lieut. Theodore Andersen, U. S. N.
Captain R. C. Bulmer, U. S. N.
Commander F. R. King, U. S. N.
Lieut. W. F. McWhirk, U. S. N.
Major E. A. Perkins, U. S. M. C.
Commodore C. G. Bowman, U. S. N.

Dues

The annual dues ($2.50) for the year 1919 are now payable.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

Address of Members

All members are urged to keep the Secretary and Treasurer informed of the address to which PROCEEDINGS *are to be sent, and thus insure their receipt.*

Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 15th of each month.

Book Department

The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles

The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations

Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice

Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., AUGUST 15, 1919.

INFORMATION INDEX

PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER WALLACE L. LIND, U. S. Navy

GENERAL ARRANGEMENT

FRANCE

FRENCH NAVAL POLICY.—It goes without saying that a power's use of its colonies depends on the command of the sea. The lessons of the war have combined with the financial situation and the temporary suppression of the German Navy in completely changing the naval policy of France. Previous to the war the Republic built mainly battleships, "arbitres des batailles," and neglected scouts and other fleet auxiliaries. Gunnery was considered to be the deciding factor and speed was systematically sacrificed. To-day the bulk of French admirals favor the application by France of the famous principles of Admiral Aube, the founder of the "jeune école," who, some thirty years since, advocated that the most reliable elements of strength in a navy reside in "le nombre, la vitesse, l'invulnerabilité, la spécialization." The able Admiral Daveluy, chief exponent in France of the doctrines of Mahan, has been convinced by the war and come round to those views. He is urging the construction by France of numerous submarines, of swarms of bombing seaplanes and of the fastest destroyers and light cruisers in the world, speed having been proved the most important element of success. With the exception of England, no power enjoys a strategic position so favorable as that of France for the utilization of flotillas, especially of aviation, that instrument of control of narrow seas. Admiral Ronarch (fifty-four years of age), the glorious hero of Dixmude, is to realize the new program.—*Army and Navy Journal*, 8/16.

THE BLACK SEA MUTINY.—The Minister of Marine made an excellent speech before the House concerning the unhappy events in the Black Sea. He set himself the task of establishing the true facts with precision, and to examine into the causes with a high degree of impartiality. His clear explanations wherein his sense of his official responsibilities is attuned to his humane sense of the circumstances, are of the kind to give one a proper appreciation of the events, and also to restore calm. He concluded as follows:

"One conclusion is deduced from these facts. The events in the Black Sea must be considered from a viewpoint taking into account all the cir-

cumstances, both moral and material, which accompanied them. The attempt to debauch our crews took place at a time when France was confronted by a maximum of danger, the moment when the last peace propositions were about to be sent to our enemies.

"The men did not understand that they could become accomplices in a move which had for its aim the saving of Germany, the defrauding of France of the reparations without which she could not live,—and leaving her with nothing but her sorrows and her ruins.

"Bolshevism is a poison which Germany introduced in Russia to destroy her. The poison did its work. She set about to destroy France by the same process, but she failed. The navy remained faithful to its duty.

"We must not be weighed down by the disorder of a few hours. During the war French sailors have everywhere conducted themselves with heroism, never ceasing in their fight against the submarine, day and night. These brave ones, who have permitted France to live and to prepare for the victory, are the ones who have shown the true valor of the bluejackets.

"Two bad days do not efface nor cause forgetfulness of the four years of heroism spent in the service of the country.

"Part of the risks of war in all long conflicts are the moral and social crises which suddenly spring up. Although fatal to the conquered, the victorious peoples feel them no more than as a discomfort or as a warning.

"Indiscipline and defeat, discipline and victory are similar terms.

"Having won the war, it is necessary, in order to gain peace, to overthrow the conspiracy of evil forces loosed against France.

"The Government counts on the aid of every Frenchman to accomplish the task in which it will not fail."

At the root of all naval rebellions we *always* find one of these three complaints: insufficient food; also often the two others, too severe discipline and too long away from ashore.

Such were the complaints of the squadron of Morard de Galles which revolted in 1794 in Quiberon Bay; such were those of the British fleet in February, 1797, when it had just barely averted the terrible menace resulting from the French attempt to concentrate the naval forces of Brest, Cartagena, and the Texel. It was then that the red flag appeared for the first time on board a man of war, and also, I well believe, what are now called "soviets."

The British sailors named in each ship twelve members of the crew which had charge of the interior discipline of the ship, and two delegates per ship, who, meeting on board the *Sandwich*, under the chairmanship of the famous Richard Parker, a common sailor, ordered the movements of the fleet. Blood was shed, and yet England was at war with France! Finally, by measures of justice and benevolence toward these erring men, and also by rigorous measures against the leaders and the incapable among the officers, all returned to their duty.

The sailors claimed an increase of pay, a bigger and better planned ration, a more equitable division of the proceeds of prizes, more advantages for the wounded, and leave to visit their families on returning from sea. All this was granted, but Parker was condemned to death and executed; several cruises, better chosen and properly conducted restored order and discipline in the crews. The rebellion had lasted three months.—*La Vie Maritime et Fluviale*, 6/25.

GERMANY

THE END OF THE GERMAN NAVY.—The dramatic end of the German Navy at Scapa Flow is an event in history which has much greater significance than the vanishing of the mushroom menace created in less than two decades by one of the most wrong-headed men the world has ever known. In the first place it stamps the nation which has just signed the peace as one which

is neither honorable nor chivalrous, nor appreciating in the smallest degree the true spirit of sportsmanship. In the second place this incident brings out in greater prominence the gross miscalculations made by Germany when she attempted to wrest the trident from British hands. The Germans built their navy under conditions which gave them all that mechanical science could afford, they used it with absolute unscrupulousness, and were protected so far as their own territory was concerned by impregnability, and yet they did not produce a result which was commensurate with the cost involved or the personnel absorbed from the nation. They overlooked the fact that we were an island nation, and being dependent on the sea for our very existence, we had acquired by long experience a sea sense which could not be artificially produced by other people, particularly a purely military nation, under different conditions. When faced with the serious problem of defending the Empire, what did our mariners do? They patiently and earnestly laid down to their job and exercised their inherited faculties and sea spirit against overwhelming odds in the first instance, until their dogged perseverance and fruitful resource brought home to their enemies the rugged truth, that do what they could it was impossible to overcome the pluck and initiative of the British mariner, whether he belonged to the navy, the mercantile marine, or the fishing industry. The criticism which has been passed on the Admiralty as to the opportunities available for scuttling the German Fleet rests on very flimsy grounds, as we fail to see what could be done to exercise surveillance over ships that we could not guard with our own men, particularly as the preparation for the simultaneous sinking of a number of ships could be carried out without any evidence of such preparation being made. The only thing which we think might have been done would have been to move the vessels into shallower water if any idea existed as to an intention to scuttle them. We have always thought from the first that the most satisfactory course was the one originally suggested to sink them in a formal way in the Atlantic. The value and utility of the ships were very small to any country to whom they might have been allotted for the reason that a war vessel is always built around the armament, and therefore these vessels, if used in the manner suggested, must have been re-equipped with new armament and navigating instruments of entirely different types to those originally employed, and consequently the cost involved was not commensurate with the end achieved. Further that when so refitted they would have been quite obsolete. The sinking of the ships by Admiral von Reuter compares very unfavorably as a naval incident with the conduct of Admiral Count von Spee in the Falklands Islands battle, which stood out as a fine example of courage and chivalry.—*The Marine Engineer,* July, 1919.

THE KRUPP GUN FACTORIES.—The *Kolnische Volkszeitung* states that the firm of Friedrich Krupp has fitted out its former gun carriage workshops for the construction of locomotives and railway cars. This firm has guaranteed the Prussian State a yearly delivery of over one thousand locomotives and over two thousand freight cars.

GERMAN LONG RANGE GUNS USED IN BOMBARDING PARIS.—The *Military Technical Review,* completing an article which appeared in a former issue gives some interesting particulars regarding the so-called long distance guns which bombarded Paris.

The article is part of an interview with Professor Rausenberger who invented those renowned guns. Although Professor Rausenberger was not willing to say much, the writer of the article is in a position to state that about eight heavy guns bombarded Paris. They were 21 and 23 cm. guns.

The 23 cm. guns were old 21 cm. guns which had been bored out. They always fired with a constant elevation of 50 degrees. The 21 cm. gun attained a range of 130 kilometers.

Their range could be changed in modifying the charge; moreover, this was also done to spare the guns as much as possible.

The French claim that three such guns were destroyed by their artillery and flying machines. That is not true for none of them have ever been hit by the enemy. One of them could no longer be used, as a shell exploded in the bore of the gun.

Generally speaking, it may be said that the French artillery which fired at the long distance guns, was very well directed from the beginning, for many German gunners were killed when the French fired for the third time. Although the French fired several hundred times with heavy guns, the German long distance guns were never hit. When the Germans withdrew, all of their long distance guns were removed to safety.

There were three groups of long distance guns, one being located near Crepey, about 119 kilometers from the central point of Paris, one south of Gugny and one west of Frere-en-Tardenois. The Germans advanced their long distance guns as soon as the strategic situation permitted them to do so. They also advanced their long distance guns in order to use them much longer, by reducing the charges.

Professor Rausenberger claims that on the ground of his experiences with the 21 and 22 cm. guns he will undoubtedly be able to construct guns of a larger caliber (30 cm.) having a range of 150 kilometers. Everything had already been prepared to construct such guns, with which it would have been possible to bombard both the mouth of the Thames and London from Cap-gris-Nez, near Calais, without being hindered from sea.—*The Military Technical Review,* June, 1919.

HOW GERMANY'S PRE-WAR TONNAGE IS BEING APPORTIONED.—In one of the May issues of the *Hamburger Nachrichten,* Rear-Admiral Hollweg, of the German Navy, discusses the future status of Germany's merchant fleet, which at the beginning of the war amounted to about 5.5 million registered tons. In the spring of 1914, the German Empire possessed no less than 1121 steamers and 136 sailing ships of more than 1000 gross tons. On January 1, 1914, 80,000 sailors were employed in the German merchant fleet.

Through capture and seizure in enemy ports at the beginning of the war, about one million gross tons of German shipping was lost immediately. Another 325,000 tons were captured on the open sea, including 125,000 tons which were forced to leave the asylum of the Suez-Canal only to become an easy prey of the English cruisers. About 2.5 million tons took refuge in neutral ports. Whenever neutral countries joined the Entente the ships lying in their harbors became liable to seizure. In this way 620,000 tons were taken over by the United States; Portugal and her colonies seized 230,000 tons; Italy acquired 170,000 tons, Brazil 239,000 tons, China 21,000 tons, Peru 43,000 tons, Uruguay 42,000 tons, Siam 18,000 tons, Cuba 16,000 tons. With the collapse of Germany's allies, another portion of her merchant fleet fell into enemy hands, viz., 80,000 tons which had sought refuge in ports of the Black Sea and in Austrian harbors.

As a compensation for losses suffered through submarine warfare, 22,000 tons of merchant shipping were turned over to Spain and 38,000 tons to Holland. Chile and Argentina took over 60,000 tons during the war for their own use and without prejudice to the property rights of German shipowners.

Tonnage Surrendered to Allies.—Originally the Allies by an agreement signed at Brussels obtained the surrender of all German merchant steamers in excess of 4000 tons. Of such steamers there were 177 of 1,414,000 tons in home ports. Forty-three of these were passenger steamers with an aggregate tonnage of 424,000 tons. The number of German steamers of

4000 tons and upwards interned in neutral ports is shown in the following table:

Country	No.	Tons
Spain	15	108,123
Canaries	16	104,314
Dutch Indies	25	224,763
Colombia	3	14,116
Mexico, Eastern Coast	1	5,544
Mexico, Western Coast	9	44,099
Danish West Indies	1	5,544
Norway	2	18,000
Argentina	10	71,083
Chile	45	274,211
Holland	20	149,907
Sweden	8	49,113
Russia	3	13,790
	158	1,082,607

Forty-two of these of 151,200 tons were passenger steamers. The vessels lying in Chilean and Argentine ports have had their machinery damaged and are not immediately available for service.

Later on the Allies insisted upon the surrender of all ships of more than 1600 tons and less than 4000 gross tons, whose aggregate tonnage amounted to 504,700 tons. This brought up the total of German shipping demanded by the victorious powers to three million tons. Upon the earnest pleas of the German shipping delegates, however, they were allowed to retain temporarily vessels of 158,975 tons subdivided as follows:

Class	Gross tons
All German Tankers	77,225
Ordinary Steamers	78,214
One Cable Steamer	3,536
Total	158,975

As a result of this concession, ships of a total tonnage of 2,842,000 have only to be surrendered to the Allies.

Recapitulation of Losses.—The losses incurred by the German merchant marine can therefore be recapitulated as follows:

	Tons
Lost at the outbreak of the war through capture and seizure	1,000,000
Lost during the war through further seizures by new belligerents	1,417,000
Lost through the collapse of Germany's allies	80,000
Surrendered as compensation for losses through submarine warfare (Spain and Holland)	60,000
Taken over for temporary use (by Chile and Argentina)	60,000
Surrendered or to be surrendered to Allies	2,842,000
Total	5,459,000

This figure corresponds almost exactly to the total tonnage of Germany's merchant fleet at the outbreak of the war. What tonnage is left in German hands is equivalent to the tonnage of the vessel construction in German yards during the war period. The amount of this is uncertain, but will probably not exceed 600,000 tons.

Whether Germany will be able to recover any of her vessels captured in enemy ports is extremely doubtful. According to the terms of the armis-

tice, Germany had to surrender the vessels captured by her during the war and condemned as prizes in her courts. In complying with this provision, Germany reserved the right to make a similar claim regarding captured German vessels.

Under the terms of the Declaration of London and of the Hague treaty, German ships which were lying in enemy harbors at the outbreak of the war or which entered such harbors after the declaration of war ignorant of the existence of hostilities were to remain German. Not all the nations, however, participating in the war had ratified these declarations of international law. As there was a clause in these treaties requiring all those participating to assent to them before they could become effective, the stipulations in question are not legally binding. The chances of Germany recovering any part of her surrendered tonnage are therefore not good.—*The Nautical Gazette*, 7/19.

GERMAN SHIPPING.—German shipowners have beoome most despondent since the signing of the Peace Treaty. The freeing of the large European rivers and opening of the German ports to the ships of the Allies without discriminatory charges blocks the way for the resumption of previous German commercial practices. All nations can now trade on the Rhine and other rivers, besides there will now be freedom in trans-shipment at German ports. The stapelrecht, Schifferzunfte, umschlagrecht and similar ordinances will not serve to enable German shipowners to control the commerce of Central Europe as they formerly did. They cannot again be used for purposes of discrimination and preferential rating.

Germans who realize what Germany has lost through the neutralization of the international waterways and the freeing of German ports declare that the Peace Treaty has sounded the death knell of Germany's mercantile marine. All her foreign transportation agencies and shipping businesses have gone to other nations.—*Shipping*, 7/19.

GREAT BRITAIN

NAVAL RIVALRY DEPRECATED.—In its leading editorial a recent issue of the *Naval and Military Record* speaking of the future development of the British Navy said: "The German fleet has disappeared . . . . and the only foreign power which has augmented its navy upon a large scale is the United States. In these circumstances it will not be easy to hit upon a working formula to represent our minimum needs. . . . . We might, of course, base our future building programmes on the corresponding efforts made by the United States, but the objection to such a course is that it would imply a rivalry in armament between the very Powers on whom the world relies to prevent fresh wars. Few people in this country would approve of a naval policy which could in any sense be interpreted as a threat to our friends across the Atlantic."—*Scientific American*, 8/2.

ROYAL AUSTRALIAN NAVY.—The court-martial has been held into the conduct of the seamen and stokers of the *Australia*, who were charged with mutiny without violence at Fremantle early this month. It was stated in evidence that when the ship was preparing to leave Fremantle 100 men gathered on the quarter-deck in "liberty" clothes, and requested that the ship should remain another day in order that they might entertain friends. The request was refused, but when the order was given to let go, the engine-room telegraphed that the stoke-room watch had left the boiler room. Evidence was given that the accused men were of impressionable temperaments and were not bad characters. They were given sentences varying from two years' hard labor followed by dismissal from the service to 12 months' imprisonment.—*Army and Navy Gazette*, 6/28.

SALVAGE NINETEEN SCAPA FLOW SHIPS; BRITISH TO HOLD NO INQUIRY.—One battleship, three light cruisers, and fifteen destroyers of the former German Grand Fleet, which were scuttled by their crews at Scapa Flow, in the Orkney Islands, on June 22, are ready to be salvaged, it was announced to-day in the House of Commons by Walter Hume Long, First Lord of the Admiralty.

Mr. Long said that the work was proceeding on three other destroyers. He said that there was no intention of holding a court of inquiry.—*New York Times*, 7/31.

"U" BOAT PIRATES.—The Admiralty have submitted to the committee dealing with the violation of war usages the names of 71 German naval officers who are charged with the inception and practice of sea outrages or callous conduct. The protocol of the Treaty provides that the names of alleged offenders whose delivery for trial is demanded must be supplied by the German Government within a given time. The offences alleged include the bombardment of non-military ports of the East Coast, submarine acts of exceptional callousness and brutality, the inception and conduct of submarine warfare generally, matters relative to the laying of mines under certain conditions, and other offences. Some of those named are actually in British custody. Every one of the accused is assured of a full and fair trial.—*Army and Navy Gazette*, 7/12.

SUBMARINES.—What the *Sunday Chronicle* calls a new submarine warning is contributed to its columns by Admiral Sir Percy Scott. Submarines, he declares, have come to stay. The war has shown that they may be our greatest danger, and we must lose no time in making preparations against them. It is well to have this obvious truth pressed home. Sir Percy Scott points out that in many respects his prophecies about submarines made two months before the war began—when he was considered by many people to be a dreamer and scaremonger—came true. He evidently agrees with Sir David Beatty that it is a thousand to one against Jutland being the last great sea battle, and thinks it useless to put faith in the League of Nations unless in peace we are prepared for war. Against the submarines of the future he suggests that our line of preparation is indicated by the success of the appliances and schemes which we put into use against the U-boats towards the end of the war. There seems to be an idea that the elaborate and successful anti-submarine organization at the Admiralty, because it was a product of the war, should now be demobilized, but if we are to be safeguarded against future possibilities it would be an entire mistake to do anything of the kind.—*Army and Navy Gazette*, 7/12.

TRIED TO SINK THE "GOEBEN."—Constantinople newspapers received here report that Turkish officers recently made an attempt to sink the former German cruiser *Goeben* at Ismid, Asia Minor, but were frustrated by British officers.—*New York Times*, 8/11.

JAPAN

TWO MORE BATTLE CRUISERS TO BE BUILT.—To complete the plans for the 8:6 squadron, the Minister of the Navy has proposed to our 39th Imperial Diet, appropriations for the construction of two (2) more battle-cruisers.

These new battle-cruisers will be substituted for the present battle-cruisers, *Kongo* and *Hei*, which will enter the second term of ship-age during the Taisho, 11th year (1922).

It has been decided to name the two new battle-cruisers *Akagi* and *Amagi* (each to be of 40,000 tons displacement). One will be built at Kure and one at Yokosuka.—*Yorozo*, a Japanese newspaper, 7/4.

THE DELAY IN BUILDING SHIPS FOR THE JAPANESE NAVY.—For t purpose of accomplishing the plans of our 8 : 8 fleet before the decided yea our Imperial Navy is now at work building ships at various places, as liste below:

Battleships:
- *Nagato* at Kure.
- *Mutsu* at Yokosuka.

Second-Class Cruisers:
- *Tenryu* at Yokosuka Naval Station.
- *Tatsuta* at Sasebo Naval Station.
- *Harima* at Sasebo Naval Station.
- *Tama* at Mitsubishi Co.
- *Kitagami* at Sasebo Naval Station.
- *Oi* at Kawasaki (Private Co. Kobe).
- *Kiso* at Mitsubishi Co.

First-Class Torpedo Boat Destroyers:
- *Ohikaze* at Maizuru Naval Station.
- *Shimakaze* at Maizuru Naval Station.
- *Nadakaze* at Maizuru Naval Station.
- *Yakaze* at Mitsubishi Co.
- *Hakaze* at Mitsubishi Co.

Second-Class Torpedo Boat Destroyers:
- *Momi* at Yokosuka Naval Station.
- *Kaya* at Yokosuka Naval Station.
- *Nire* at Kure Naval Station.
- *Kuri* at Kure Naval Station.
- *Nashi* at Kawasaki Dockyard (Private Co. Kobe).
- *Take* at Kawasaki Dockyard (Private Co. Kobe).
- *Kaki* at Uraga Dockyard.
- *Toga* at Ishikawajima (Private Yard, Tokyo).

Some submarines, torpedo boats, and other ships for special duty are to be built.

On account of the scarcity of materials and workmen during the war, and the high market price of materials the building of ships has been delayed greatly. But together with the end of the war, having on hand a surplus of labor and materials over industrial requirements there will be no hindrance for the construction of cruisers and smaller warships.—*Tokyo Nichinichi,* a Japanese newspaper, June, 1919.

CONSTRUCTION OF ANTI-AIRCRAFT GUNS BY JAPANESE NAVY.—Reflecting upon the rapid development of aeroplanes in all nations, our Imperial Navy has been conducting an investigation at Kure Arsenal to perfect anti-aircraft guns, especially for the purpose of defence against aeroplane attack. After designing the most complete and effective high-angle guns, at present our navy is making a large quantity of them rapidly, to install on war vessels from big warships down to submarines. Furthermore, if the expense is not restricted our navy has a plan to place them on the tops of high mountains which surround our naval ports, and secondary naval ports, to make complete defence against aeroplane attack.—*Asahi,* a Japanese newspaper, 7/4.

NEW JAPANESE BATTLESHIP LAUNCHED.—The launching ceremony of the *Nagato* (30,000 tons) the largest battleship in the world, which is now under construction at the Kure Dock Yard, will take place this coming November. The ship is now being equipped. Most of her equipment may be accomplished before she is launched. Heretofore the time required for installing the equipment was one year and four months. The *Nagato* will be fully equipped within the short time of five or six months after launching. This will break the record.—*Mancho,* a Japanese newspaper, 24/6.

NAMES OF NEW JAPANESE TORPEDO BOAT DESTROYERS.—The torpedo boat destroyers which will be constructed during the Taisho 8th year (1919) were given names as follows:

Shiokaze, first class torepdo boat destroyer.
Akikaze, first class torpedo boat destroyer.
Yukaze, first class torpedo boat destroyer.
Tachikaze, first class torpedo boat destroyer.
Hokaze, first class torpedo boat destroyer.
Kiku, second class torpedo boat destroyer.
Aoi, second class torpedo boat destroyer.
Hagi, second class torpedo boat destroyer.
Susuki, second class torpedo boat destroyer.
Fuji, second class torpedo boat destroyer.

—*Jiji*, a Japanese newspaper, 5/29.

THE JAPANESE NAVY IS TO EXPERIMENT WITH ELECTRIC DRIVE.—As was expected, the Imperial Navy Department will set about to investigate concretely, sooner or later, electric drive for our warships. The Shibaura factory is now studying the manufacture of two or three kinds of electric-driven propellers of about 300-horsepower each.

Some time during the spring of next year the electric drive will be installed in special duty ships of 200 or 300 tons for the purpose of practical investigation.

Admiral Kato, Minister for the navy, and Vice Admiral Tochinai, Vice Minister, are most earnest for the investigation.

Probably during the 43d Diet, the estimated cost of the investigations will be laid before Parliament.—*Tokyo Nichinichi*, a Japanese newspaper, 6/6.

UNITED STATES

OUR NEW BATTLESHIPS.—Battleship No. 53 for the United States Navy, to be named the *Massachusetts*, the contract for construction of which was awarded recently, will have a length of 684 feet over all, which is an increase of 60 feet over ships of the *Idaho, New Mexico* and *Mississippi* class, the largest now afloat in the U. S. Navy. Its extreme beam will be 106 feet, as compared with 97 feet 4½ inches, the beam of the *Idaho*. In displacement there is a decided increase. The specifications require a displacement of 43,200 tons, as compared with the *Idaho's* 32,000 tons displacement. Instead of specifying a certain degree of horsepower, the contractors are required to guarantee a speed of 23 knots, which is in itself a decided increase over the 21 knots that the ships now in operation are able to develop.

The *Massachusetts* will be an oil burner, equipped with the new electric turbo-generator drive. Its battery will consist of 12 16-inch guns, mounted in two double-tiered turrets; 16 6-inch guns, four 3-inch anti-aircraft guns, and a number of smaller guns for use on boats and for landing parties. In addition there will be two 21-inch submerged torpedo tubes. Its crew will consist of 1,129 men and 62 officers. There will be additional accommodations for 160 men in case it ever seems desirable to increase the complement of the ship.

The *Massachusetts*, as well as her sister ship, No. 54, to be named the *Iowa*, will have the same large cruising radius that characterizes all recent American battleships. Their armament protection and under-water protection against torpedo attack will be unusually complete and will include features which the experience of the war has shown to be of the most vital importance. They will also be equipped with a high-power radio. There will be a reception and reading room for the crew; the men's quarters will be heated and ventilated by a system of warmed forced air. Complete hospital accommodations and dental offices are provided. Showers with hot and

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLET[illegible]
AS REPORTED JULY 31, 1919

Type, number and name	Contractor	Per cent of comple[illegible] Aug. 1, 1919 Total	Aug. 1, 1919 On ship	July 1, [illegible] Total	July 1, [illegible] On ship
Battleships					
43 Tennessee	New York Navy Yard	82.1	77.6	79.1	7[illegible].6
44 California	Mare Island Navy Yard	68.4	60.3	65.6	5[illegible].6
45 Colorado	New York S. B. Co.	28.4	7.4	26.8	[illegible].6
46 Maryland	Newport News S. B. & D. D. Co.	51.3	42.2	49.7	3[illegible].9
47 Washington	New York S. B. Co.	28.	6.8	26.2	[illegible].3
48 West Virginia	Newport News S. B. & D. D. Co.	24.2	2.2	23.4	[illegible].2
49 South Dakota	New York Navy Yard	0.	0.	0.	[illegible].
50 Indiana	New York Navy Yard	0.	0.	0.	[illegible].
51 Montana	Mare Island Navy Yard	0.	0.	0.	[illegible].
52 North Carolina	Norfolk Navy Yard	0.	0.	0.	[illegible].
53 Iowa	Newport News S. B. & D. D. Co.	0.	0.	....	....
54 Massachusetts	Fore River S. B. Co.	0.	0.	....	....
Battle Cruisers					
1 Lexington	Fore River S. B. Co.	Plans	being	revis	ed
2 Constellation	Newport News S. B. & D. D. Co.	Plans	being	revis	ed
3 Saratoga	New York S. B. Co.	Plans	being	revis	ed
4 Ranger	Newport News S. B. & D. D. Co.	Plans	being	revis	ed
5 Constitution	Phila. Navy Yard	Plans	being	revis	ed
6	Phila. Navy Yard	Plans	being	revis	ed
Scout Cruisers					
4	Todd D. D. & Const. Co.	29.7	7.8	28.2	[illegible]6.1
5	Todd D. D. & Const. Co.	27.3	6.	26.4	4.9
6	Todd D. D. & Const. Co.	22.1	1.3	21.7	1.2
7	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
8	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
9	Wm. Cramp & Sons Co.	14.	....	12.	....
10	Wm. Cramp & Sons Co.	14.	....	12.	....
11	Wm. Cramp & Sons Co.	3.	....	2.	....
12	Wm. Cramp & Sons Co.	3.	....	2.	....
13	Wm. Cramp & Sons Co.	3.	....	2.	....
Miscellaneous[1]					
Fuel Ship No. 16, Brazos	Boston Navy Yard	98.5	98.4	97.	[illegible]6.5
Fuel Ship No. 17, Neches	Boston Navy Yard	26.	14.	25.	[illegible]0.
Fuel Ship No. 18, Pecos	Boston Navy Yard	.2	.2	.2	.2
Gunboat No. 21 Asheville	Charleston Navy Yard	90.5	85.5	88.1	[illegible]3.1
Gunboat No. 22	Charleston Navy Yard	5.	4.	4.	3.
Hospital Ship No. 1, Relief	Phila. Navy Yard	43.3	36.9	37.1	[illegible].4
Amm. Ship No. 1, Pyro	Puget Sound Navy Yard	93.	88.	92.	[illegible].
Amm. Ship No. 2, Nitro	Puget Sound Navy Yard	57.	41.	52.	[illegible].
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	0.	0.	....	....
Destroyer Tender No. 3, Dobbin	Phila. Navy Yard	0.	0.	....	....

[1] Miscellaneous vessels authorized but not under construction or contract (3):
1 submarine tender No. 3.
1 destroyer tender No. 4.
1 transport No. 2.

There are 154 destroyers, 62 submarines, 7 mine sweepers, 18 sea-going tugs, 19 har[illegible] tugs, 12 oil tankers and 37 Ford eagles in various stages of completion. 12 destro[illegible] 3 submarines, two mine sweepers, 7 ocean-going tugs and 8 Ford eagles were comp[illegible] and delivered to the Navy Department during the month of July.

There are 12 additional destroyers and 10 submarines authorized but not under con-struction or contract.

d water appliances, a barber shop, laundry and complete commissary partment are included. The *Massachusetts* and the *Iowa* will be completed in about 42 months from the time of laying their keels, which will oon be done.

The Bureau of Construction and Repair is now studying the airplane and seaplane situation with the purpose of determining what modifications of battleship construction will be necessary to meet the needs of the new ships from air attack, and before these ships are completed the results of the investigation which Rear Admiral David W. Taylor and his associates are conducting will be available and the superstructure of the ships designed to conform to the needs of naval aviation.—*Army and Navy Journal, 26/7.*

NAVAL POLICY

SHALL THE SUBMARINE BE OUTLAWED?—In the deliberations at Paris and elsewhere since the armistice was signed there have been specific propositions toward a general limitation of armaments, and these propositions lean rather strongly toward outlawing the use and possession of submarines. The arguments pro and con have been fully considered by the experts of the U. S. Navy and we are indebted to Capt. Thomas C. Hart, U. S. N., of the office of the Chief of Operations, Navy Department, who has studied the situation from every angle, for the following estimate of the situation:

"The danger of a repetition of the German submarines' inhuman warfare on commerce by some nation that the future may develop into similar irresponsibility and ruthlessness. This is the strongest argument of the abolitionists and is easily appreciated by everyone. Their opponents, while condemning the inhumanity of the German submarine warfare to the utmost, do not think that these past horrors should be a determining factor. They also point out the enormous effect on the war occasioned by the German submarine campaign, as compared with the actual cost of life. It is generally granted that the Germans failed in their plan to win the war by submarines only because they could not bring them into service in sufficient numbers; at their best, the average number of Germans actually fighting at sea in submarines was about 1000 officers and men and there were literally hundreds of thousands opposed to them; the number of men in Allied vessels engaged continuously and exclusively in strictly anti-submarine work outnumbered the German submarine personnel many fold. Exact statistics are not yet available, but estimates of the actual cost in lives of the German 'unrestricted' warfare are between 10,000 and 15,000—the best figures give about 12,000. Many single day's operations on land cost more lives than that and with infinitesimal results as compared with the effect of the submarines.

"Those not in concurrence with the abolitionists think that the factor of possible mercilessness of submarine warfare should not be separated from the possibly worse horrors of gas, bombing from the air and mines. As for the latter, the parallel seems closest. Only the absolutely ruthless submarine compares with the automatic mine which knows no difference between the bottoms of battleships, hospital ships and passenger ships filled with women and children. That due attention must be given this point is shown by actual loss returns; the losses of British merchant ships, during the war, was by—

Submarines	5,739,000 tons
Mines	6,377,000 tons

The Germans, of course, were mostly restricted to mining from their submarines alone, but once the mine is planted the character of the vessel that did it means nothing. In the last year or so of the war the Allies' defensive measures against mines were largely annulling their effect; but the possibility of future mine inventions that will change this desirable situation is too likely to permit leaving them out of the argument.

"A second argument given emphatically in favor of abolition is that submarines when restricted to their legitimate use of torpedoing the men-of-war of their enemy are not effective—as shown by the small losses of Allied surface warships caused by them in the last war. Those favoring retention point out the fact—as shown by captured instructions—that the objective given German submarines—after there was a sizable force of them—was merchant tonnage, because they estimated the results to be thus attained would soonest win the war for them. It is pointed out that, with the exception of the abortive attempt of last November for which their submarines *only* went to sea, the Germans never planned to have a fleet action and that during the encounters that did occur only casual German submarines participated. Submarine advocates therefore argue that the war furnished no data in the way of results on which conclusions should be based. However, it appears that of the 134 surface warships which the British Navy lost during the war by enemy action sixty-two were sunk by torpedoes from German submarines.

"The argument is made that despite all hydrophone and kindred inventions of a long period during which the best inventive talent of several nations worked under high pressure the submarine is still the only long-radius vessel which, singly and unsupported, can go well nigh anywhere and that, entirely discounting its main purposes of torpedoing enemy warships, as a matter of coast defense, in fleet action or otherwise, its unique defensive quality makes it a naval weapon of utmost usefulness; at the worst, it is never a liability that has to be supported and protected. That the big ship still rules the ocean seems to be generally accepted. How long it will endure is the question. The war has brought no basic advancement to big ships, only a continuance of increase in size, speed and also expense, which for single units has become tremendous. No one can begin to guess what advance the next decade or two will see in other weapons, now properly classed as auxiliary. But this much seems clear: If there can be evolved no limitation in character or size of naval armament, any nation which holds blindly to one line and fails to note development along others will be in ultimate danger from some other nation which does.

"At first the practicability of abolishing submarines seemed high, for the reason that it is purely a war machine only, has no place in commerce or sport and would be difficult to conceal if possessed in readiness for war. There is of late, however, more doubt as to this practicability on the part of those who are keenest to outlaw them and evidences of fear of failure to enforce the prohibition and consequent comparative detriment of our national defence. While the leaders of those nations having the strongest navies have shown a disposition to agree to general abolition of submarines, and destruction of those built, it has gone no farther than that; other nations state that, having weaker navies, the submarine is most important to them, support the arguments for retention and even frankly state that they cannot concur.

"As with most other questions of the day, national altruism seems scarce, their own best national interest determines what is proposed and the pro and con arguments, as briefly and incompletely given above, must be taken, when published, as being intended to persuade to his way of thinking other than the writer's own nationals. It is still to be hoped that there may be evolved from this world situation something in the way of direct armament limitation—both quantitative and qualitative and including in the latter perhaps total prohibition of gas, mine, bomb-dropping and submarine warfare. Unless thus included with other restrictions there seems no chance whatsoever of outlawing submarines. They are therefore likely to be found in all navies in increasing numbers; the prospective increase in capability and war value is only bounded by the enthusiasm of the prognosticating individual."—*Army and Navy Journal*, 8/9.

THE AMERICAN FLEET.—The reported decision of the United States Navy Department to constitute two fleets of approximately equal strength for duty in the Atlantic and Pacific is the natural outcome of the great increase in battleship strength since the existing scheme of distribution was formulated. Owing to the fact that the Panama Canal is in their hands, the Americans have the means to reinforce either fleet very quickly, and thus an objection which might be raised against the division of strength on strategical grounds cannot have the same force as it would have done before the canal was available. Incidentally it may be noted that Great Britain has decided upon a united squadron for duty on both sides, instead of one for North American waters and one for the Pacific Coast, which implies that our ships will be allowed to use the canal as freely as those of the United States. On the other hand, it is always open to us to reinforce our ships on the Pacific Station, as we did in the war, by vessels from the China Seas and from Australasia. Now that the United States have made the Hawaiian Islands a first-class naval base, and a half-way house to the Philippines, it is natural that they should station a much stronger fleet in the Pacific.—*Army and Navy Gazette*, 6/28.

THE U. S. PACIFIC FLEET.—The U. S. Pacific fleet, under Admiral Hugh Rodman, in its passage through the Panama Canal demonstrated fully the strategic value of the waterway by passing from the Atlantic into the Pacific with the greatest ease. The large battleships were passed through the locks almost as easily as canal boats. The entire fleet steamed into Colon early on the morning of July 25 and took on coal and oil. The fleet passed through the canal on July 26, and the average time from Colon to Balboa was ten hours, minus the time spent at anchor in Gatun Lake. The flagship *New Mexico* was the first ship of the fleet to pass through the canal. She was raised out of the three locks of Gatun Dam in one hour and fifteen minutes, and this brought her and the remainder of the fleet eighty-five feet above the sea level. The *New Mexico* was lowered in the two locks at Miraflores in fifty-five minutes, the depth being fifty-five feet to the lake.

The fleet arrived off San Diego August 6 with the exception of the battleship *Rhode Island*, the flagship of Squadron 1, and the battleship *North Carolina*. The *Rhode Island* broke her starboard shaft when she was about 675 miles west of Balboa, and the *North Carolina* took her in tow to return to Balboa. It is reported to the Navy Department that the after compartment of the shaft alley of the *Rhode Island* was flooded, but there were no casualties. On August 2 some of the vessels were reported to have been severely tossed by an earthquake shock, or tidal wave, but the shocks were not recorded by the seismograph at Georgetown University.—*Army and Naval Journal*, 8/9.

MATÉRIEL

A BATTLESHIP COSTS $32,000,000.—The Navy Department estimates that the two super-dreadnoughts for which bids were recently received, will cost with armor and guns a total amount of $32,000,000. These are ships of the 1916 program, and they show an increase in construction cost during the war of nearly 100 per cent. The increase has been progressive, with a big jump, of course, during the past five years. Thus the *Alabama* (11,565 tons) of 1900 cost $2,722,000; the *Connecticut* (16,000 tons) of 1906 cost $4,096,000; the *Florida* (21,825 tons) of 1911 cost $6,400,000; and the *Nevada* (27,500 tons) built in 1915, cost $11,000,000.—*Scientific American*, 2/8.

NEW PACIFIC FLEET NUMBERS 175 SHIPS.—Approximately 175 ships, with an aggregate tonnage of more than 500,000, constitute the newly-organized Pacific fleet. At full strength the armada will be manned by about 34,000

the figures of deliveries made in June, 1918, when the total tonnage delivered to the United States Shipping Board was 280,400 deadweight.

SUMMARY OF DELIVERIES FOR JUNE, 1919

		D. W. T.	Gross
Contract steel ships	63	361,458	243,652
Requisitioned steel ships	7	52,825	35,217
Wood ships	47	160,800	107,200
Composite ships	1	3,500	2,333
	118	578,583	388,402

Total number of ships reported accepted by the United States Shipping Board from August, 1917, to June 30, 1919, is 1104 with a total tonnage 5,826,664 d.w. or 3,884,443 gross.

Approximately twice as much seagoing tonnage was delivered to the Board in June, 1919, as was delivered in the United States during the year 1916. In that year, which marked the record of pre-war production, 38 seagoing vessels of over 1500 deadweight tons (1000 gross), totaling 285,555 deadweight tons (190,370 gross) were built in this country.

During June, 1919, deliveries made to the United States Shipping Board exceeded by two the entire number of seagoing vessels of 1500 deadweight tonnage (1000 gross tons) delivered in the United States in the 48 pre-war months from 1913 to 1916 inclusive.

June deliveries include 109 seagoing vessels each of not less than 3500 deadweight tons (2,333 gross), and nine tug boats; tonnage not given.

LAUNCHINGS FOR JUNE, 1919

		D. W. T.	Gross
Contract steel	61	391,850	262,635
Requisitioned steel	4	28,750	18,167
Wood	32	76,100	50,728
Concrete	1	7,500	5,000
Total for month	98	504,200	336,530

JUNE, 1918, LAUNCHINGS

		D. W. T.	Gross
Composite	1	3,500	2,333
Contract steel	13	74,300	49,533
Requisitioned steel	13	77,050	51,367
Wood	22	78,700	52,467
	49	233,450	155,633

It will be noted that the launchings for last month show an increase over the same month last year of 40 ships. It will also be seen that many of these ships are of the larger type. The increase in tonnage launched as compared with June, 1918, amounts to 270,750 deadweight tons or 180,897 gross tons. This is an increase of 111 per cent tonnage over the same month last year.—*Shipping*, 7/19.

SIXTY-TWO TRADE ROUTES BEING OPERATED BY THE SHIPPING BOARD.—The United States Shipping Board now has 829 ships, of 4,248,873 deadweight tons, engaged in the general commerce of the seas, exclusive of more than 2,500,000 tons still in war service for the army and navy and in overseas civilian food relief work.

The board has established and now has under operation 62 regular general cargo liner services in trade routes which have been opened in the last

handed, however. Naval officers expect the arrival of the Pacific fleet on the west coast to result in stimulating recruiting throughout the West.—*N. Y. Times*, 7/24.

NORTH SEA MINE SWEEPERS BUSY.—Mine sweepers of the British Navy and the United States Navy are now engaged in making a final sweep of the North Sea. The work is being shared equally between the two fleets, and the "All clear" may be expected some time about the end of November. But this signal will, of course, apply only to the removal of moored mines, and not to a few illusive "strays."

There are over 400 British mine sweepers in the North Sea at the present time, and their business is to gather up what are left of the war. British moored mines still exist off the Belgian, Danish, Dutch, German and Norwegian coasts. The British mine sweepers service is composed entirely of volunteers, and consists of some 600 officers and 14,000 men.

The United States mine sweepers are stationed up by the Orkneys. The Americans laid the large mine field belt which practically stretched from the Orkneys to the coast of Norway, and the removal of this lengthy chain of death now falls to their share.—*Shipping*, 7/19.

MERCHANT MARINE

GIGANTIC NEW LINERS.—Two gigantic ocean liners, larger than any now afloat and designed to cross the Atlantic in four days are to be built by the Shipping Board. Each will be 1000 feet long, of thirty knots speed and will be equipped for use as a commerce destroyer in the event of war. Plans for the ships have been completed, and work on them will be started in the near future. It is proposed to provide a special terminal for them at Fort Pond Bay, L. I., and it may be that two similar liners will be constructed later.

The ships, which are to be built under the supervision of the Navy Department, will be 50 feet longer than the famous *Leviathan*, now the largest ship afloat, and will have a gross tonnage of 55,000. Their draft will be 35 feet, depth 74 feet, beam 102 feet, and accommodations will be provided for 1000 saloon passengers, 800 second cabin passengers, and 1200 steerage passengers.

The crew will number 1000 officers and men, and the ships will be of the oil-burning type with a cruising radius of 7000 miles, which will enable them to complete a round trip on the Atlantic without loading fuel overseas. They will be driven by four propellers and have engines of 110,000 horsepower.

In order that the vessels may be converted into commerce destroyers in time of war, gun emplacements will be built on the decks and the afterdeck will be constructed with a view of transforming it into a landing space for sea planes.

Construction of a terminal at Fort Pond Bay, Montauk Point will represent a large outlay, but the Board's announcement said a great natural depth harbor was provided there, and that in addition the location would reduce the voyage to Plymouth, England by 118 miles, the distance being 2,878 miles as compared with 2,996 miles from New York City. The plans provide for double tracking the present railroad from Montauk Point to New York so as to care for the passengers and freight handled by the new liners.—*Shipping*, 2/8.

OUR SHIP LAUNCHINGS AND DELIVERIES MARK REAL PROGRESS.—Statistics compiled at the beginning of this week by the United States Shipping Board show that 118 vessels, total tonnage 578,583 deadweight, were delivered by American shipyards to the United States Shipping Board in the month of June last. These figures show an increase of 106 per cent over

4. Give owners control over their goods at all times and enable them to work them up into all forms and grade and pack them for export with the minimum of expense.

5. Release nearly two-thirds the capital now required for financing foreign trade.

6. Greatly reduce freight handling, insurance, storing and transportation charges.

7. Assist America in meeting her commercial competitors in the world's markets on a more equal basis.

8. Develop better port facilities and equipment than any now existing.

The establishment of free ports in America is a pressing necessity. In recent years a great change has been made in the character of our internal commerce. We are now a manufacturing as well as a producing country. Our exports of manufactured goods are as valuable as our exports of foodstuffs. If we desire to forge ahead and develop foreign trade and a sound mercantile marine, while preserving protection, we must have free ports. Otherwise circumstances will profoundly change our commercial tendencies.—*Shipping*, 7/12.

NAVIGATION AND RADIO

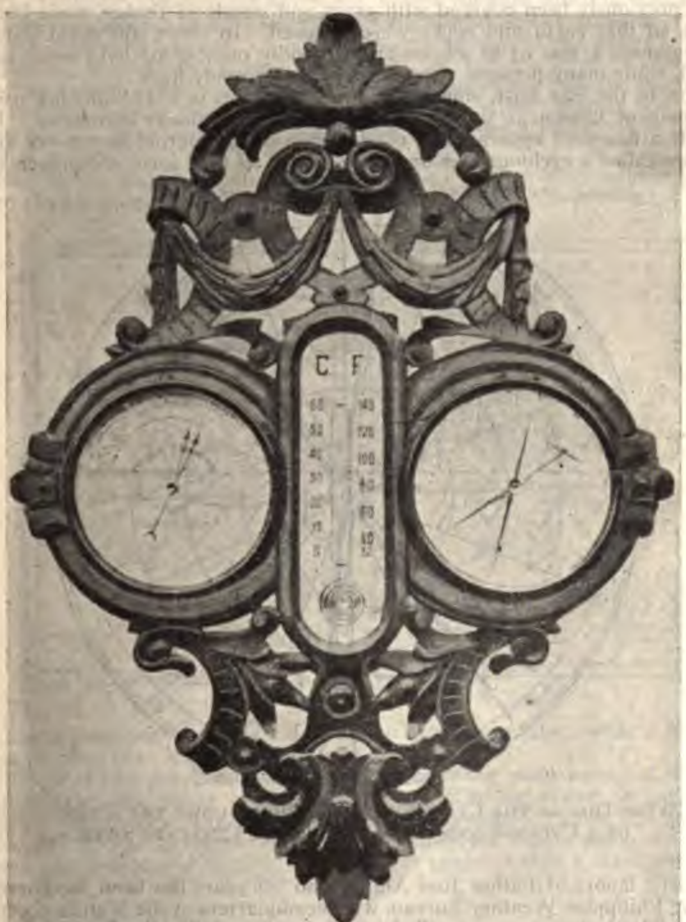
THE ALGUÉ BAROCYCLONOMETER A SENTINEL AGAINST THE UNEXPECTED COMING OF THE HURRICANE.—That the "East is West" has many a pertinent application, and this is peculiarly the case in the matter of dealing with those tempests that are born somewhere on the bosom of the sea and spend their awful might progressively over far-flung areas.

Out in the Orient they have the typhoon, while in this hemisphere we have its smaller kin, the hurricane of the West Indian waters and the neighboring regions of the North Atlantic. Both are types of cyclonic storms; and it is because of the violent nature of their rotary winds that devastation so frequently marks their paths. Certain instrumental means developed to forewarn of an advancing typhoon have to-day notable value in helping us to predict the approach of a hurricane and to take steps which may minimize its ravages.

Most of us know by repute, if not by actual experience, just how destructive a hurricane can be at times; and not infrequently the loss of life or the injury to property is due to the lack of precautionary measures. That is to say, the ship at sea unwittingly heads right into the tempest when it could just as easily steer away from the storm center; again, the craft at anchor in an exposed harbor, inviting disaster, could avoid certain ruin by bravely taking to the open sea; and, finally, lives are imperiled by waiting too long before seeking places of security.

Reasons are multiplying that make it all the more of vital concern to us that we should have advance knowledge of the whereabouts of a distant hurricane and be able to follow its course and foretell just where it is likely to cross the lanes of shipping, touch our insular possessions, or strike our southern shores. Month by month, the volume of water-borne traffic threading the Caribbean Sea, the Gulf of Mexico or the Atlantic Ocean contiguous to the West Indies, is going to increase as peace re-establishes and amplifies our foreign trade. Similarly, the coasts of Florida and the littoral of other Southern states are drawing to them added dwellers and stimulating industries, aside from luring the yachtsman and many other pleasure-seekers. And, further, we have assumed additional responsibilities in the way of warning of impending hurricanes by our purchase of the Virgin Isles. Recognizing this, the United States Weather Bureau is establishing at Fort Myers, Florida, a special station for the purpose of detecting and predicting the approach of hurricanes. Before the authorities are through, we shall probably have a series of these meteorological outposts scattered throughout our West Indian holdings, and why this should be done can be realized if we cite merely a single instance of the havoc wrought in large part through a lack of advance knowledge of the oncoming tempest.

On the evening of October 9, 1916, the Virgin Islands were swept by the most destructive hurricane that has occurred in that area since 1867. The hurricane broke upon them with little warning. Only a short while before the storm arrived hurricane signals were hoisted and the customary guns

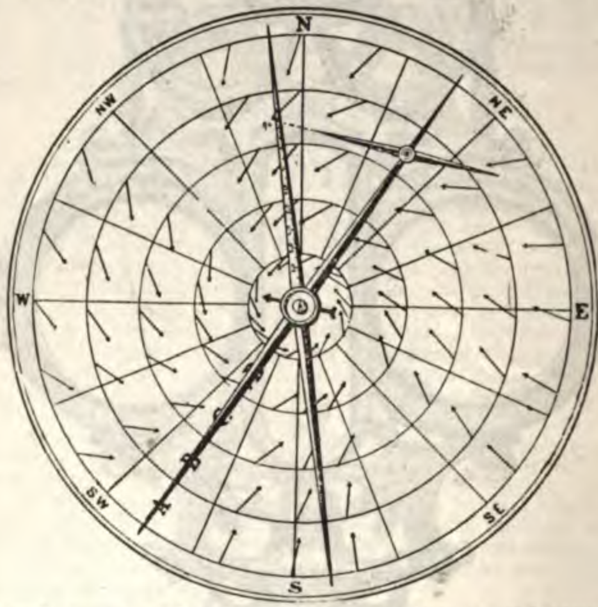


A. BAROCYCLONOMETER. THE WIND DISC IS ON THE RIGHT AND THE BAROMETER ON THE LEFT OF THE THERMOMETER, WHICH GIVES READINGS OF TEMPERATURE, BOTH BY CENTIGRADE AND FAHRENHEIT.

fired to spread the news abroad beyond the visible range of the bunting. These signals, unfortunately, did not suffice to arouse the populace to prompt action—they were too late; and well-nigh before storm shutters could be adjusted on homes, and other buildings, the skies let loose their torrential rain and angry gusts of wind—the forerunners of the body of the hurricane—swept the islands. The blast rapidly grew in intensity until the wind attained a maximum velocity of about 125 miles an hour. Vessels

were driven ashore and wrecked. The Danish cruiser *Valkyrien*, however, just managed to ride out the blow in safety, thanks to her two bow anchors which were out, and to her engines, which were kept running at full speed. In some instances houses were torn bodily from their foundations and smashed to pieces against other buildings or trees. Again, hillsides which had previously been covered with grass and stands of timber, were blasted bare so that earth and rocks were exposed. In short, the total damage represented a loss of $1,500,000 and a goodly number of lives were sacrificed, while many persons were more or less gravely hurt.

Out in the Far East, since 1901, there has been in ever-widening use an instrument known as the barocyclonometer or typhoon barometer. It is really a two-fold apparatus: a combination of an aneroid barometer and a device called a cyclonometer or wind disc. In its final form it represents the



THE WIND DISC OF THE CYCLONOMETER WHICH SHOWS THE VARIOUS ZONES OF A CYCLONE AND THE WAY THE AIR CURRENTS SWIRL.

climactic labors of Father José Algué, who for years has been the Director of the Philippine Weather Bureau, with headquarters at the Manila observatory. The instrument was called into being to amplify the field of usefulness of the ordinary aneroid barometer, and next, to supply information which the barometer cannot give—information essential to locating the whereabouts of the cyclonic storm center and then to following its onward sweep. His primary object in developing this ingenious apparatus was to save life and property as far as possible, and likewise to dissipate to a measurable degree that terrifying alarm which used to grip the inhabitants of the Philippines when the cyclone season was upon them.

Until about the beginning of the eighties, typhoons swept from their unknown places of birth in the Pacific down upon the hapless peoples of the Philippines, causing grave sacrifices, many of which might have been avoided or lessened had the natives been sufficiently forewarned. This has all been changed by the aid of the barocyclonometer, simply because that

instrument had made it possible to forecast the coming of the typhoon when that tempest is a full 500 miles away. Not only that; through it the observer can determine the probable regions over which the storm will vent the worst of its fury.

The typhoon, just like the hurricane, moves forward more or less deliberately, its approach being heralded by natural phenomena, sometimes days before it actually arrives. It is the rotary intensity of the storm's body, increasing towards the vortex which does the greatest harm. Therefore one can readily grasp how important it is to foretell not only the coming of the cyclone, but the line of travel of its dreaded center. Father Algué has used for the foundation of his barocyclonometer the previous work of two fellow priests.

Nature has her own good way of divulging her intentions. Our problem is to read her signals aright. Years ago at the Havana Observatory, Father

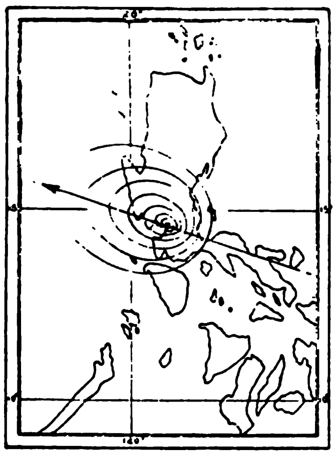


FIG. 1

FIG. 2

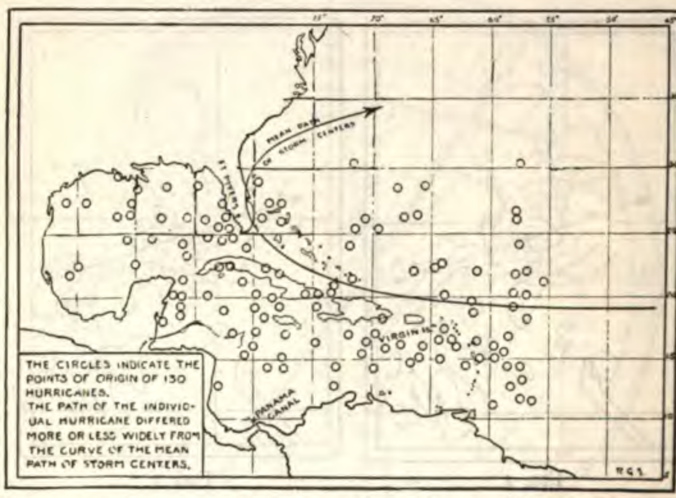
Fig. 1 illustrates the zones of barometric pressure taken while a typhoon was passing near Manila.

Fig. 2 shows graphically the way in which the wind swept at the distances from the center of the same storm. The big arrow, in each case, marks the general line of advance of the typhoon. Thus the pressure recorded by the barometer indicates the different zones, while the winds mark the compass direction of the storm center which a navigator does his utmost to avoid.

Benito Vinés sought to find in the heavens some premonitory signs of the gathering hurricane, with which he was distressingly familiar. He found that high in the sky, days before the storm broke, certain cirro-stratus clouds of a comet-like form which hung persistently aloft day and night, invariably preceded a tropical tempest of a cyclonic character. These feathery clouds dipped toward a common spot upon the horizon, and repeated observations proved that they pointed towards the vortex or center of the atmospheric disturbance. They were the outermost swirls of the rotary winds—the cyclone area covering a possible diameter of a thousand miles. Father Vinés's studies furnished the groundwork for a further series of meteorological investigations by Father Algué, and these in turn led to the invention of the wind disc of his barocyclonometer.

The barometer, as most of us know, is sensitive to differences of atmospheric pressure; and an area of high pressure commonly means fair weather, while a low pressure region is just as often the provocation for foul weather. This is because we have a depression, so to speak, in the atmosphere toward which the outlying "high" rushes to fill and to re-establish uniformity. This movement gives us the winds, which we call storms or tempests, according to their violence; and the more abrupt the changes of barometric readings within relatively short distances the greater the velocity of the atmospheric movement, *i. e.*, the wind.

While the barometer will give warning of threatening weather when the center of the disturbance is hundreds of miles away, still the instrument has no sense of direction—it will not tell where the cyclone is lurking. Here is where the preliminary studies of storm clouds by Father Vinés served to guide Father Algué. By the use of special instruments, which he



RECORDS OF POINTS OF ORIGIN OF WEST INDIAN HURRICANES FROM 1876 TO 1911.

designed and built, Father Algué was able both to photograph and to measure the height of the clouds characteristic of more than two hundred typhoons.

His data showed that the cyclonic winds invariably swept the clouds, like so many curving spokes of a wheel, toward the vortex. He was able in this way to prove that the winds had fairly uniform direction for different compass divisions of the typhoon body as well as for each succeeding zone of the storm—working from the center of the tempest outward to its uttermost rim. These winds varied with the season of the year, and in themselves indicated whether the observer were to the north, south, east, or west of the dreaded mælstrom.

This sounds simple, but it took a vast deal of patient research and the reducing to "means" of meteorological records covering many years to get the germ of the problem. It was upon these averages so painstakingly established that the practical application of Father Algué's discoveries was based.

Strange as it may seem, particularly in the tropics and semi-tropic areas, the normal daily and nightly oscillations of the barometer vary with

markable regularity, and because of this rhythm any decided change is positive evidence of meteorological disturbance in the nature of a storm. Father Algué's predecessor at the Manila Observatory had devised a e of barometer which did give warning of the proximity of typhoons, it was distinctly local in its value and misleading when relied upon ond the Philippines. His problem was to design an instrument which uld be of helpful service in any part of the Eastern seas; and to achieve s it was necessary that the apparatus be adjustable so that it might be to suit a particular area. Father Algué's aneroid barometer has, in ect, a double face or dial consisting of an inner fixed disc and an outer volvable flat ring upon which are engraved the different weather sectors d arcs denoting the nearness or remoteness of the storm center. This ing can be swung to correspond with the seasonal and local conditions which should prevail normally in fair weather at the point in question. Any variations of the barometer from these local standards, therefore, are sure indices of atmospheric turbulence thereabouts.

For convenience's sake, the cyclone sector of the dial ring is divided into A, B, C, and D areas—representing distance—which show how far away the storm is. These zones, surrounding the center of the tempest, have been carefully determined by an exhaustive analysis of meteorological records covering years of observations. Thus, by means of his wind disc and his adjustable barometer, the priestly scientist has furnished both the mariner and the man on shore a storm-warning apparatus of great value. Seven years ago, at the instance of the Navy Department, Father Algué visited Havana and then came to this country, where he made a close study of the weather records, and afterwards adapted the barocyclonometer for use in the North Atlantic and the approaches to the eastern end of the Panama Canal. It is this modified form of his wind disc and barometer which is henceforth to stand guard against the unexpected coming of the West Indian hurricane.—*Rudder,* August, 1919.

HYDROPHONES AND THEIR USES.—At the recent hydrographic conference at Liverpool, the employment of hydrophones was urged as a means of lessening the danger of navigating the high seas. It has long been known that sound waves travel through water four times as fast as in air, but this knowledge could not be put to any practical use on account of the impossibility of determining by the human ear either the source or the direction of sound waves traversing a water medium. Two years ago, however, Lieutenant Georges Walser, of the French Navy, perfected an instrument for picking up sound waves out of a body of water and transmitting them to a listener stationed on a vessel. Briefly described, the new device consists of an acoustic lens fixed on the side of a vessel in the bulging surface of which there are a number of round holes ranged in a circle and each filled with a sensitive vibrating plate or sound focal point. When the sound waves strike this lens, they are deflected, strengthened and isolated from other sounds. The listener on shipboard is equipped with a listening helmet to which are attached two ear trumpets, which can be revolved past the focal points above mentioned. By taking the focal point at which the sound is heard loudest and clearest through the trumpet, the direction from which the sound waves originate and their distance can then be calculated with the help of an ingeniously arranged scale placed alongside of the edge of the drum whose handle must be turned in order to revolve the ear trumpets. Thanks to this device, U-boats at a distance of fifteen miles could be accurately located and overtaken during the war. At the present time, the hydrophone is being successfully used for sound ranging in the North Sea in connection with the removal of the mines planted while the war lasted. As it would reveal the approach and exact location of machinery propelled craft bound in their direction, merchant vessels equipped with this recent invention would run very little risk of

collision even in the thickest fogs. By catching the sounds emitted by a bell buoy, those in charge of a ship out of its course could gauge its distance from shore thereby avoiding the risk of running aground. Considerable time may elapse before the hydrophone is generally adopted by merchant men, but once it is universally installed, ocean navigation in obscure weather will be robbed of many of its present perils.—*The Nautical Gazette*, 8/9.

TRISECTION OF AN ANGLE.—An exceedingly simple construction for the trisection of an angle is as follows:

$B\,A\,C$—Fig. 1—is the given angle. At any point D in $A\,B$ draw $D\,E$ parallel to $A\,C$. With centre D and radius $D\,A$ describe the circle $A\,F$. Choose any line passing through A and cutting the circle and $D\,E$ in points F and E, such that $E\,F = A\,D$. Then $\angle E\,A\,C$ equals one-third of $B\,A\,C$.

PROOF. $A\,D = D\,F = F\,E$ by construction. $\therefore \angle D\,A\,F = \angle D\,F\,A$ and $\angle F\,D\,E = \angle D\,E\,F = \angle E\,A\,C$. $\therefore D\,E$ is parallel to $A\,C$. But $\angle D\,F\,A =$

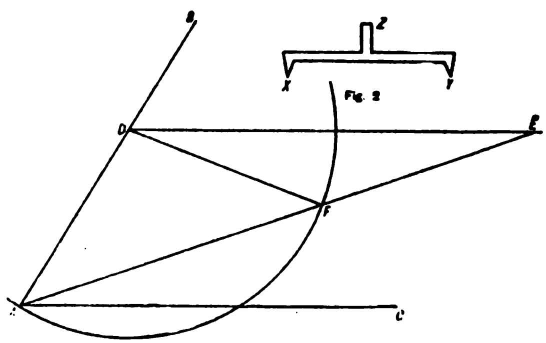


FIG. 1

$\angle F\,D\,E + \angle D\,E\,F =$ twice $\angle D\,E\,F$. Therefore $\angle D\,A\,F =$ twice $\angle E\,A\,C$. $\therefore E\,A$ trisects $B\,A\,C$.

This problem is not strictly Euclidean in that Euclid does not provide for the rotation of a line to such a position that the intercept on two other lines is of a certain length, but as a practical problem it is exceedingly useful.

As an addition to a set of mathematical instruments the gadget shown in Fig. 2 forms a useful adjunct.

The pin Z is arranged to fit into leg of the compass such that the center point of the compass and points X and Y all lie always in the same straight line. The distance $A\,D$ is marked off so as to be equal to the distance between the points $X\,Y$, and the circle center D and radius $A\,D$ is drawn in accordance with the figure. The center point of the compasses is then set to A and the compasses rotated and adjusted until X falls on point F and Y on point E. The straight line $A\,F\,E$ can then be drawn in, and this will trisect the angle.—*Engineer*, 7/4.

RADIO MONOPOLY URGED BY NAVY DEPARTMENT.—Legislation of far-reaching importance in its bearing on radio communications between the United States and the rest of the world is being sought by the government at Washington, as part of the plan for monopolizing transocean and international radio service to and from American shores, as well as between ship and shore.

In identical letters to Vice-President Marshall and to Speaker Gillett of the House, Secretary Daniels asserts that government operation and control of all transocean and ship-to-shore wireless stations used for commercial purposes in this country is "necessary, on account of present interference between stations," and sets forth what the Navy Department regards as other cogent reasons why these important fields of radio telegraphy should be dealt with by the Federal Government as a natural monopoly.

The legislation sought by the Secretary of the Navy seeks legislation along these lines: (1) Study of radio problems within the United States by a special committee or commission; (2) authority for the President to establish bands of wave lengths for transocean and ship-to-shore services; (3) government monopoly of transocean and international radio service; (4) authority for the navy to use immediately all navy radio stations for commercial or press business; (5) authority for the navy and other departments to aid in the development of American-owned radio stations abroad and the use by them of government-owned patents and improvements.—*N. Y. Times*, 7/29.

PACIFIC COAST RADIO STATIONS.—With the completion of a series of radio compass stations now in process of construction by the government, the North Pacific Coast will be in possession of radio facilities of material help to coastwise navigation.

Radio compass stations are now being installed at Tatoosh, Dungeness and a point on the San Juan Islands. In addition to the radio stations being built at the entrance of Puget Sound and on the strait, others are being established on the coastline near the entrance of Grays Harbor and along the Oregon and California coasts.

With the establishment of these compass stations, each of which are located short distances apart, so as to comprise a chain along the entire coastline, a vessel at sea may readily obtain its position in case of heavy fogs or other disturbances. The ship sends a radio which is picked up by the shore compass stations and the position computed and flashed back to the vessel. At twenty-five miles off shore, a ship's position can be deducted within a mile; at five miles off the position is figured within two boat-lengths.—*Shipping*, 8/9.

NORWEGIAN INVENTION OF RADIO TELEGRAPHY DEVICE.—According to *Norges Handels og Sjorfartstidende* of May 6, 1919, Engineer Hermod Petersen has recently patented a device for the production of electrical current for radio telegraphy. The electricity is received by an accumulator, which releases it at certain intervals. The system is sparkless, and the sounds are clearer than in the older inventions. The clearness of sound depends upon the regularity of the current, and with this system the current is released with a mathematical exactness. The device is claimed to be cheaper, simpler, and more durable than those now in use. If the claims made for this invention prove well founded, it is thought that it will mark a distinct step in advance of what has so far been accomplished in this line, and hence its possibilities are creating considerable interest in the radio world.—*Shipping*, 8/2.

RADIO TRANSMISSION FORMULAS FOR ANTENNA AND COIL AERIALS.—The aerial of a radio transmitting or receiving set is either a condenser or an inductance coil of large dimensions. It effects the transfer of power between the radio circuits and the ether. The coil aerial has the inherent advantage of serving as a direction finder and interference preventer, but is less effective quantitatively as a transmitting or receiving device than the condenser aerial commonly called the antenna. The practical question, how far can communication be maintained by a coil in comparison with an antenna, is answered by the following formulas, derived from electromagnetic theory. A flat-top antenna is considered, and a rectangular coil.

Let h = height of antenna or coil, l = horizontal length, and N = number of turns of wire of coil aerial, I = current, λ = wave length, d = distance apart of transmitting and receiving aerials, R = resistance of receiving aerial circuit. The subscripts s and r refer to sending and receiving, respectively. All lengths are in meters.

Antenna to antenna:

$$I_r = \frac{188.\, h_s h_r I_s}{R\lambda d}$$

Antenna to coil:

$$I_r = \frac{1184.\, h_s h_r l_r N_r I_s}{R\lambda^2 d}$$

Coil to antenna:

$$I_r = \frac{1184.\, h_s l_s h_r N_s I_s}{R\lambda^2 d}$$

Coil to coil:

$$I_r = \frac{7450.\, h_s l_s h_r l_r N_s N_r I_s}{R\lambda^3 d}$$

These formulas were derived by J. L. Dellinger, of the Bureau of Standards two years ago and have been found useful in the Signal Corps and navy work since that time. Either the equations as here given or the component equations giving the field produced by a given antenna or coil aerial and the received current produced by a given field, lead to the solution of questions of design which it would be difficult to settle by experiment. Such quantitative experiments as have been made have verified the formulas to 25 per cent or better, some observed values of received current being higher and some lower than the theoretical values.

The actual current received when a coil aerial is used is frequently greater than the formulas indicate, because such an aerial acts both as a coil and as an antenna by virtue of its capacity to ground. This double action of the coil structure is likewise indicated by values obtained for radiation resistance and by the observed directional properties.

The use of the coil aerial is particularly advantageous, as may be seen from the formulas, for short waves. In most cases, the usefulness of the coil increases as its dimensions are made to approach the order of magnitude of the wave length. An advantage of the coil not apparent from the formulas is that its resistance can usually be made lower than that of the corresponding antenna.—*Journal of the Franklin Institute*, July, 1919.

ENGINEERING

ALCOHOL AS MOTOR FUEL.—Increased demands for gasoline with accompanying increase in price have again directed attention to the utilization of substitutes, particularly alcohol, as fuel for internal-combustion motors. The supply of petroleum is limited, and as this limit is approached the price is certain to advance still more, it having doubled during the past six years in this country and more than doubled abroad. On the other hand, the supply of alcohol from vegetable matter is practically inexhaustible, and the sooner it comes into general use for power purposes the longer will the gasoline supply be conserved.

Heretofore the restricted use of alcohol has been due to its inability to compete in price with gasoline, this handicap having been intensified by governmental restrictions. Whether the point has now been reached where successful competition is possible, is a matter for investigation.

The British Government, viewing with concern the rising price of gasoline, last November appointed a committee to inquire into the production and utilization of alcohol as a motor fuel. This committee has recently submitted its report. It found that while alcohol is obtainable from molasses, potatoes, wood pulp and other vegetable products, the yield, contrary to popular opinion, is not large; that from potatoes, for instance, being only twenty gallons per ton. It can also be produced synthetically from coal and coke-oven gas, but the most promising source appears to be from tropical plants of which the sun-dried flowers of the mahua tree will yield ninety gallons per ton.

The usability of alcohol in internal-combustion engines with a properly designed carburetor and slightly modified compression is well recognized, so that there is no obstacle from the engineering standpoint. It is purely a commercial problem. Owing to the somewhat lower heat value of alcohol a correspondingly greater quantity must be used per horsepower-hour, so that in order to compete with gasoline the cost per gallon must be proportionately less.

As a means of keeping down the cost the committee recommends that the British Government modify the restrictions concerning the storage and distribution of alcohol, consistent with the prevention of its improper use—a recommendation that might well be given serious consideration in this country. It reports further that, while not definitely committed to the idea that the time has arrived when alcohol can compete commercially with gasoline, it believes nevertheless that such time is not far distant and strongly urges that steps be taken by the British Government to carry on such investigations and give such support to the alcohol industry as will put it on its feet to meet any further increase in the price of gasoline.

While true that the motor-fuel situation is much more acute in England than in this country, yet would it not be well for this government to profit by the recommendations of the British committee and by a little forethought through investigation avert a possible crisis a few years hence?

Some eight or ten years ago an effort was made to interest the farmer in the utilization of farm refuse for the production of alcohol on a small scale. To this end certain restrictions were removed, as applied to farms only, and the Department of Agriculture issued instruction pamphlets. The response to this effort, however, was small, perhaps owing to the then low price of gasoline and to the fact that the farmer at that time was not a large user of internal-combustion engines. But that condition has changed, the farmers now have their automobiles and are large users of internal-combustion engines to drive the various farming implements. Perhaps a renewal of the former efforts would now bring results.—*Power*, 8/5.

DEVELOPMENT OF THE SEARCHLIGHT.—A review of the work of the Army Engineer Corps in the war, first issued by the War Department, says that the corps produced a new form of searchlight more powerful than any that had preceded it in any army, with which the Second Field Army had been partially equipped. "It weighed," the report says, "one-eighth as much as lamps of former design, cost only one-third as much, was about one-fourth as large in bulk, and threw a light 10 per cent stronger than any other portable projector in existence." Still further to perfect the searchlight, our engineers were at work on a remote control when hostilities ceased.—*Scientific American*, 7/19.

BURNING POWDERED COAL.—With the increasing cost of coal, while at the same time the quality steadily decreases, it becomes of greater and greater importance to find the most efficient methods for combustion. The burning of coal in powdered form is conceded to-day by engineers to be the eventual method for coal combustion, since it offers opportunities for high

efficiency and controlled combustion not offered by any other method of burning.

Few people realize, unless closely in touch with this development, how much has been accomplished during the past five years. Since the early '90's the cement industry has been using powdered coal as its fuel, and to-day it may be said in all truth that the successful and cheap production of cement rests on the firing of rotary kilns with powdered coal as standard practice. In 1912-13-14, the use of powdered coal in firing numerous large reverberatory furnaces used for smelting copper ores was successfully worked out. To-day some of the great copper producers are burning hundreds of tons of powdered coal daily.

The use of powdered coal has reduced fuel consumption to such an extent that to-day some plants are smelting six tons of ore with only one ton of powdered coal. The whole trend of the copper smelting industry has been changed by the use of powdered coal in their enormous furnaces. In the early days powdered coal was injected into the furnace with a stream of high-pressure air. Even when firing in such a crude way as this, the results were such as to make the use of this fuel in the cement industry a much more efficient method of kiln firing than any other method used up to that time.

In developing the use of powdered coal in other fields where smaller furnaces were to be fired and more delicate operations carried on, it became necessary to work out other burning equipment in order to have better control over combustion, to speed up combustion and to get away from the disadvantages of injecting the coal stream with a jet of high-pressure air and the poor mixture obtained by this method. This change to the use of low-pressure air was a change necessary to bring about the widespread application of this fuel as has been seen in the past five years.

Equipment has been developed which is self-contained and easily regulated, and which will burn quantities of coal as low as one ounce per minute. From this extremely small capacity the equipment ranges up to the capacities demanded by the largest industrial furnaces and boilers.—*Engineering World*, 7/15.

NEW CHISEL STEEL OF UNUSUAL PROPERTIES.—An American steel company, making all grades of electric tool steels, announces that it has produced an alloy chisel steel which can be made so hard that it will cut glass yet may be bent by being hammered over the edge of an anvil. This steel, the manufacturer states, has a wide temperature range, as it may be heated anywhere between 1650 and 1950 degrees F., and yet give good results.

The steel seems to have its greatest value when heated to 1750 to 1800 degrees, quenched in oil and slightly drawn. The drawing it is stated, does not seem to affect the hardness of the steel, but it helps the toughness. Many theories can be evolved as to just why this slight drawing is of such assistance to this steel, but metallographically there is no evidence of difference between straight hardening and hardening and drawing. The same structure can be produced as seen under the microscope, yet there is a great deal of difference between the two heat instruments.

A point emphasized is that the head of a chisel made of the new steel will not sliver. It is also stated that the head of the chisel can be heat treated so that it may be filed, yet it will not break out or crack. It will spread, but it will not split, yet the top of the head does not take on a very glassy surface and seems to have a grip on the hammer-face when it is struck.

It is pointed out that metallographically the steel is peculiar. It seems to have a very fine structure, which is difficult to define. It may be a solid solution which is generally regarded as austenite, or it may be martensite. It seems under the microscope to have an appearance at lower magnification of the whole range of solid solution steel, yet it has the characteristics of

none. Under high magnification of 1200 diameters the structure appears to be somewhat like martensite, yet the martensite appears to be lamellar rather than the usual 60 degrees marking.

The grain boundaries, which are particularly tenacious, have the coloring effect of troostite, yet they do not have the usual troostite formation. Troostite does not begin to form in round spots at the grain boundaries in Seminole steel, but seems to have the characteristic of broadening out the grain boundary into a dark line. From this stage the entire grain begins to etch a little more rapidly and take on a darker color, but the ground mass of the grain does not appear to alter in general characteristics as is usually found in the transformation from austenite, martensite, troostite and sorbite, as understood as applying to the usual form of alloy steels or carbon steels.—*Scientific American*, 8/2.

COPPER IN RUSTPROOF STEEL.—In a paper recently read by D. M. Buck before the American Society for Testing Materials, it was brought out that very small amounts of copper have the effect of reducing corrosion in steel. Tests were made of open hearth steel with various copper additions, so that there was from 0.012 to 0.254 per cent of copper in the ingots. These were rolled into sheets and exposed to the atmosphere in the Connellsville coke region, together with a number of pieces in which there was no copper. It was found that a mere trace of copper was sufficient to prevent rapid corrosion.—*Scientific American*, 7/26.

SHIPPING BOARD TO MAKE DIESEL ENGINES.—According to recent dispatches from Washington, the United States Shipping Board has taken over the right to manufacture one of the standard European Diesel engines, and will manufacture them on a vast scale. This is in line with the decision of the Shipping Board made over a year ago to undertake motorship construction. Officials of the Board say that America is compelled to adopt the motorship to meet European competition.

Among the chief reasons for discarding the steamship in favor of the motorship are, according to the Shipping Board: Saving of two-thirds of the oil used as fuel. Saving of more than 25 per cent in wages due to the cutting down of the engine room force and the entire elimination of the fire-room gang. Increase of a vessel's steaming radius from a few thousand miles to not less than 30,000 miles. A contract for the construction of the engines has been let in Pennsylvania and in less than three months one completed Diesel engine will be delivered each day.—*The Nautical Gazette*, 7/19.

INTERESTING APPLICATION OF HEAT.—A recent issue of the *General Electric Review* describes a method of heat shrinking for fitting parts of electrical machines on to their shafts. The method overcomes various difficulties experienced with press fittings. Water or steam heating is used for flywheels and couplings, while for armatures and field systems conveniently situated heating resistances answer the requirements. In one case mentioned, *i. e.*, a large armature, the shaft was 35 inches in diameter. Cold pressing would have required a maximum pressure of 600 tons. By heating the armature to about 80 degrees C., however, the shaft could be pulled on with a five-ton chain hoist.—*Scientific American*, 8/2.

LIBERTY.—A TRADE-MARK REGISTERED BY THE UNITED STATES OF AMERICA.—A certificate of registration of the trade-mark "Liberty" as used on aeroplane engines was granted by the United States Patent Office to the United States of America on June 17, 1919. This is the first instance of the government of the United States registering a trade-mark under its own trade-mark laws, or the laws of any other country, although other governments have registered their marks in the United States Patent Office for the goods on which they are used. The Republic of France has registered

marks used on cigarettes, and several registrations have been granted by the United States Patent Office to the Imperial Government of Japan. Some government activities, such as the War and Navy Department's Commission on Training Camp Activities, have been granted registration of their trade-marks.

Everything connected with the history of the mark "Liberty" as used by the United States on its aeroplane engines is unique. When the Liberty engine was first developed in the summer of 1917 it was referred to by the government engineers as the "United States Standard Aircraft Engine" or the "United States Standard Engine." Some genius, however, selected the right word and all the district offices of the Bureau of Aircraft Production, which was then the Equipment Division of the Signal Corps, were soon notified that the use of the word "Liberty" as applied to the new engine was so popular that it seemed inadvisable to attempt to use any other name. This word was a happy selection.

Trouble resulted in a short time, however, from the great popularity of the word "Liberty" as applied to articles of commerce. Many manufacturers began to designate their goods by the term "Liberty." This use of the term on goods which are of the same general class as engines or on goods adapted to be used on engines resulted in confusion and probably in deception. Government officials soon saw that it was necessary to protect the name. After considering several ways of getting the best protection of the right of the government in the use of the word "Liberty," the plan of registering it in the United States Patent Office under the United States Trade-mark Law was adopted. These proceedings resulted in the grant of certificate of registration No. 125,853, which under Section 16 of the Trade-mark Act constitutes *prima facie* evidence of ownership of the mark "Liberty" as used on engines and parts thereof.—*Aerial Age, 7/27.*

TRANSLATING DRAWINGS FROM METRIC TO ENGLISH MEASUREMENT.—Sometimes it is necessary to translate metric dimension drawings into fractional inch drawings, or *vice versa.* Incidentally different standards for pipes, bolts, threads, etc., are incorporated so that ultimately the two designs are not interchangeable.

If we establish the arbitrary rule that one inch shall equal 24 mm., all sixteenths may be expressed in millimeters and only one decimal place is involved. Now, 4 inches = 101.6 mm., while we made 4 inches = 96 mm.; accordingly the metric version of the designer's pipe-dream has shrunk 4½ per cent. This is generally quite harmless, but is eminently useful as it eliminates a great deal of figuring.

Gears of which the center distances have been translated in the above fashion will work out with metric (module) cutter with very little trouble. Take, for instance, two gears of 4 pitch with 14 and 19 teeth; the first has a pitch diameter of 3½ inches and the latter 4¾ inches and the center distance is 4⅛ inches.

According to our way of calculating 4⅛ inches = 99 mm. To get the module we divide, 2×99, by the sum of the teeth, thus:

$$\frac{2 \times 99}{33} = 6$$

The metric gears will thus figure out to be $6 \times 14 = 84$ mm., and $6 \times 19 = 114$ mm., and the center distance

$$\frac{84 + 114}{2} = 99 \text{ mm.}$$

According to the American Machinists Handbook the table comparing the pitch and module cutters or gears shows that the translated gear is just as strong—for all practical purposes—as the original gear. This example is not specially selected; it was chosen at random, but with

7-pitch gears, results may not be obtained at the first shot. This scheme is also friendly to metric bolt sizes as they increase by 3 mm. To proceed in the reverse direction two rules may be selected from. The first, 25 mm. = 1 inch, gives all even millimeters in two decimals; the design shrinks less than 1 per cent, but involves the use of unwieldy decimals.

The second, 24 mm. = 1 inch, gives all millimeters which are multiples of 1½-inch sixteenths and the design swells about 5 per cent; for instance, 419 mm. is not a multiple of 1.5, the figure nearest to it is 418.5 = 17$\frac{7}{16}$ inches and the error introduced if the latter figure is taken is perhaps not sufficient to throw the design out of plumb.

Needless to say, the above method of calculating, which is used by Dr. C. P. Schwartz, in the *American Machinist,* applies best when a design has to be adapted without attempt at interchangeability.—*Engineering and Industrial Management,* 7/10.

CONDENSERS ON TURBINE SHIPS PLYING IN THE TROPICS.—On a turbine-propelled vessel built to run between home and tropical countries it is essential that an ample condensing plant be installed to deal with the high-temperature sea-water of the tropics. Otherwise a considerable falling off in efficiency will take place, with a corresponding reduction in the speed of the vessel.

The adverse effect of high-temperature water on the vacuum in a condenser is very marked. Investigations and experience have shown that if provision be made for home waters only, a drop in vacuum of 1½ inches to 2 inches may be expected in tropical waters. The reduction in economy and power developed with this reduced vacuum is appreciable, and may be taken at a minimum figure of 10 per cent, which would correspond to a reduction in the speed of a vessel of at least 3 per cent, or half a knot in a vessel of 17 knots normal speed.

The maximum temperature of sea-water in the tropics may be taken at 85° to 87° Fahr., and it is impossible under this condition, if the plant be properly designed, to obtain a vacuum of 27½ inches. This entails a considerable increase in condensing surface over that required for home waters only, and may amount to at least 40 per cent of extra surface, with additional pumping capacity of probably half this amount.

The attainment of high vacuum with turbine machinery under all conditions of service is most important and the saving in economy effected by fitting an ample condensing plant will justify the extra cost involved in its manufacture.—*Nautical Gazette,* 7/19.

AERONAUTICS

HELIUM.—Up to the present time all military and most other balloons have been filled with hydrogen. This gas, although giving the greatest lift which it is possible to secure, is so highly inflammable as to make the destruction of balloons by fire, not only in war time, but during operations under ordinary conditions, a serious matter. For example, the writer happens to know personally of twenty-six cases in which kite balloons or dirigibles have been completely destroyed by fire, caused by atmospheric or frictional electricity, during the last two years. Many attempts have been made to minimize this fire hazard by fire-proofing balloon fabrics, and by use of hot air or ammonia in place of hydrogen, but so far without success. The use of helium instead of hydrogen affords absolute safety from fire, whether caused by accidental electric sparks or by incendiary or explosive bullets of an enemy in time of war. An adequate supply of helium will, therefore, entirely revolutionize balloon practices, and will do more than any other one thing to assure to the nation possessing it, that control of the air which will in the future be absolutely necessary for any adequate plan of national defence.

The history of helium is interesting. About 70 years ago, a line was discovered in the spectrum of the sun's atmosphere, which could not be identified as belonging to any element known on the earth. This unknown gas was, therefore, named helium. Many years later, a thimble full of a gas, occurring in very minute quantities in the earth's atmosphere, was isolated by Sir William Ramsay, and proved to be the hitherto unknown element to which the name helium had been given. It was then proved to be not only incombustible, but inert in every other chemical way and to have about twice the density of hydrogen. Still later it appeared that this gas is formed whenever radium or any other radio active material disintegrates and for a time active chief source from which helium was obtained in small quantities for scientific research was certain radio active minerals. Still later helium was found to be a constituent of certain natural gases, particularly those occurring in Southern Kansas, parts of Oklahoma and Northern Texas, and processes were developed at the University of Kansas for purifying it so cheaply that it could be sold to scientists, in small quantities, at something like $1700.00 per cubic foot. At that time the total quantity of reasonably pure helium in the world was probably less than 100 cubic feet. In the face of so discouraging an outlook, some one in the British Admiralty had imagination enough to propose seriously that helium should be produced in sufficient quantities for the British Balloon Service, and experiments were undertaken in Canada for this purpose. A report on this matter was found in a mess of British documents sent to this country soon after we entered the war, by the Gas Warfare Committee of the Bureau of Mines and the matter was brought to the attention of the Signal Corps and the Bureau of Steam Engineering. Since that time about six millions have been either spent or obligated, the entire practicability of the production of helium on a large scale at a cost of ten to fifteen cents per cubic foot has been demonstrated, and production plants to yield 40,000 to 60,000 cubic feet per day are now being constructed or under test.

Three processes, alike in fundamental principles, but differing in important details, are being tried. One of these, the Linde process, has demonstrated its success and is the basis of the production plant now being built. The second, the Claude process, gives promise of a somewhat lower operating cost than the Linde process, but has not yet been entirely perfected. At present, this plant is temporarily shut down until the new government pipe-line can provide it with an adequate supply of undiluted Petrolia gas, at which time the final test will be made. The third process, invented by Norton and developed by the Bureau of Mines, is the basis of the large experimental unit in Plant No. 3. This unit is still being worked into shape by Norton, the inventor, and it is hoped that satisfactory results will be forthcoming within the next two months. It gives promise of an operating cost lower than either of the others.

The active supervision of the production program for helium, with the exception of Plant No. 3, has been placed in the hands of the Navy Department by mutual agreement between the army and navy. All that it is necessary for the army to do at the present time is, therefore, first, to keep in touch with the work the navy is doing in behalf of both departments; second, to prepare itself for the proper utilization of the helium that will be supplied to it under the agreement with the navy, and, third, to assume the responsibility of providing an adequate supply of the necessary raw material, in the future.

It is further suggested that there is much to be done before the army will be ready to use this new gas in the most effective way. A small repurification plant has already been authorized and plans for it are nearly completed. The question of modifying the designs of the various types of balloons in use, so as to make them appropriate for helium, should be undertaken at once. The chief difficulty is connected with the very large

waste of gas involved in the methods of handling balloons at present in use. This waste of gas will have to be very largely reduced by careful experimentation and by changes both in balloons and in the manual of tactics before the use of helium in balloons of the army types will be justified from the point of view of the whole problem of national defence.

Finally, it must be remembered that the supply of helium in the United States, although large, is by no means unlimited. At the present time probably a million cubic feet per day is being fed through the natural gas mains of various cities in the Middle West and being dissipated into the atmosphere through thousands of chimneys. Steps should be taken at the earliest possible moment to secure for the army and navy the right to process all supplies of natural gas containing usable quantities of helium before this gas is distributed. The details of such a procedure will require careful study and for this purpose an Argon Conservation Committee consisting of a representative of the navy, a representative of the army and a representative of the Bureau of Mines was appointed last August by the Aircraft Board and an adequate allotment to cover its expenses recommended. For various reasons effective action by this committee has seemed impossible until very recently. It is now hoped that the committee can proceed with its work in the near future.—*Aerial Age*, 8/11.

A ZEPPELIN SECRET REVEALED.—To many people one of the chief minor mysteries of the war centered round the means whereby our authorities were made aware, well in advance, of a projected airship raid against this country. That they were so informed in some manner or other soon became obvious to all, at least in the London area, for it was seen that on the nights upon which raids occurred the searchlights were not practiced at dusk. On one occasion, we can remember, it was confidently asserted that the warning was received of a probable raid almost twelve hours before it actually took place. The mystery has now been solved, and that by one of no less authority than Lord Weir himself. It was quite a simple matter after all; the Germans told us they were coming! Their airships were guided across the North Sea by means of directional wireless on a system involving the sending out of frequent signals from the airships themselves. These signals were picked up by the German wireless stations, which thereupon transmitted to the vessels signals indicating their exact position. Unfortunately for the enemy we also could pick up the signals sent out by the airships, and just as readily as the Germans determine therefrom their position. We thus always knew when they were coming and where they were coming from, and arranged our defences accordingly. Our own directional wireless system, perfected late in the war, avoids this serious military objection to its use. The directional coils are carried by the aircraft, which, picking up signals from home stations, is able to locate its position without telling it to the enemy. It would have been employed, it is confidently believed with success, to guide the two Handley-Page four-engined machines which were ready on November 8 to fly from this country through the clouds to Berlin and back.—*The Engineer*, 7/25.

THE COST OF A BIG AIRSHIP.—In the British House of Commons recently, Dr. MacNamara, replying to Lieut. Commander Kenworthy, said: "The cost of constructing an airship of *R-34* type is approximately £350,000. The cost of the housing shed at East Fortune, together with extensions and wind-screens, is approximately £166,000. Fourteen officers and 400 men are required at the station for handling, berthing, cleaning airships, etc. The estimated total monthly cost of the airship when in commission depends on the distance flown. Taking as basis 8000 nautical miles per month at a speed of 40 knots, it amounts to about £2600 at current rates for cost of petrol, oil, and gas. This figure includes the wages of crew, and also one-fourth the total pay of the personnel required for handling,

etc., as this latter is adequate for maintaining four airships in commission. No further airships of this class are under construction, but six of improved types have been ordered and are in varying stages of construction. Work upon them is being continued.—*Shipping*, 8/9.

PLAN CABINET AIR OFFICER.—Combination of the army, navy, marine corps, and postal air services into one separate department, headed by a Secretary of Aeronautics, who would be a Cabinet officer, is proposed in a bill introduced to-day by Representative Curry of California.

The department would have control of the development of commercial aviation and the issuance of licenses to civilian airmen. The Secretary of Aeronautics would be appointed by the President, confirmed by the Senate, and receive a salary of $12,000.

A feature of the bill is its provision for an aeronautical academy to train fliers. The establishment of aircraft factories is also provided for. The operations division of the department would prepare plans for national defence and mobilization.—*N. Y. Times*, 7/29.

ELECTRICALLY-HEATED CLOTHES FOR AIRMEN.—The extreme cold encountered at the higher altitudes makes it necessary to provide electrically-heated clothes for airmen, at least in the instance of most military machines which offer no protection to the passengers. The energy required to heat these suits is generally around 80 watts, disposed as follows: Helmet, 20 watts; each glove, 16 watts; each moccasin, 14 watts. The energy is supplied at 12 volts, either from a storage battery or from a small fan-driven generator of streamline shape mounted on the airplane, the fan being rotated by the passage of the plane through the air. The heating elements are flat loops of resistance wire spaced about seven per inch and about 9/32 inch wide per row. They are machine-sewed on a cotton cloth base, the cotton thread being carried along the top and bottom of each row of loops parallel to the horizontal axis of the row. Flexibility results from this mounting, and the base can be stretched or crumpled at will without danger of breaking the wire. Each heating element is composed of two bare wires in contact with one another throughout a considerable part of every loop, so that if a break occurs in any one wire, the effect is merely to force the small amount of energy concerned through a conducting path of smaller cross-section between the break and the near points of contact.—*Scientific American*, 8/2.

NAVY AVIATION DIVISION DISCONTINUED.—Admiral William S. Benson, Chief of Naval Operations, issued instructions on July 22 discontinuing the Aviation Division of the Office of Naval Operations and distributing its various activities among the bureaus of the Navy Department. Capt. T. T. Craven, Director of Naval Aviation, under the new arrangement will occupy the position of a liason officer. In his instructions Admiral Benson calls attention to the fact that the plan of the office of Naval Operations embraces the following divisions of work: Planning Division, Matériel Divison, Intelligence Division, Communication Division, Inspection Division, Operating Forces and Files and Records Division. He directs that the Planning Division absorb the Aviation Section, the Submarine and Mining Section, and Gunnery Exercises and Engineering Performances Section, and that the matériel of these sections be handled by the Matériel Division of his office. He also directs that the administration of personnel and training matters be handled by and directly under the Bureau of Navigation, and that the operations of submarines and navy aircraft be administered under the Division of the operating forces of his office.

The discontinuance of the Aviation Division entails the distribution of all activities and follows the navy system of separating the administrative from production and operating requirements. It would seem to be in line with

three hundred miles away. Where the balloon cable enters the fog might indicate the approximate position in which a machine of normal glide should make the plunge, while the balloon observer would signal the direction he should take. A weighted wire let down about 20 feet below the level of the machine, and arranged to light a flash lamp in front of the pilot's eye when the weight touches the ground, would tell him the moment to "flatten out." Given a level aerodrome and a machine of really low gliding and landing speed, this idea should prove a success.

For night fog-flying the same idea could be arranged, balloon and cable being strongly illuminated and searchlights brought into use either pointing along the landing ground or vertically at its corners to mark its extent.

The hanging wire connected with a flashlamp was used by seaplane pilots landing on unlit water after night patrols or raids, and proved quite successful.

Absolute reliability and schedule running is not to be expected at first. Did any form of transport make such progress in its early days as aviation has done since 1914? When Bleriot flew the Channel it was regarded as a freak performance, and now the Atlantic flight is being described as such. It is a step—a significant stage in aviation, just as was the first steamship crossing in the thirties.

The fact is, that design and construction of aircraft are ahead of engines and meteorology. "Performance" was our shibboleth during the war—speed, climb, and contortional ability. As a result the qualities that make for reliability and success in civil aviation were left behind to some extent. It is surely the first duty of civil aerial organizers to prove that in these qualities we can gain and keep the same supremacy as we held in the more warlike attributes on November 11, 1918.—*United Service Magazine,* July, 1919.

MISCELLANEOUS

PROPOSED SCIENTIFIC ESTABLISHMENTS FOR THE FUTURE.—With a view to developing and extending the scientific results which were obtained under stress of war, the British Admiralty has recently put forward proposals for the permanent establishment of a Department of Research and Experiment within the navy.

Plans have been formulated for the erection of a Central Research Institution for the investigation of first principles and for carrying on researches of a fundamental and pioneer character. Steps have alreadv been taken to organize a sea experimental station and to provide buildings and equipment for an engineering laboratory, a wireless and signal school, and a torpedo and mining school in place of Vernon.

It is believed that these institutions will prove of great value in developing not only means of increasing the efficiency of the navy, but in providing aids to navigation for our mercantile marine.

The initial expenditure for buildings and equipment will be large, but it seems evident that an ample financial return will in a short time be obtained for the nation from profits accruing from a lowering of the rates of insurance and from a reduction in the cost of transportation. If we could by the use of such aids to navigation as have been referred to above prevent two or three wrecks per year, or lower the time of passage between Great Britain and Canada on the average by one day per voyage per ship through the fog-covered areas in the neighborhood of Newfoundland, sufficient funds would be saved in a year or two to cover the whole cost of the expenditure on scientific and experimental establishments and on the prosecution of the researches and investigations foreshadowed.—*The Engineer,* 7/25.

NAVY SETS NEW RECORD.—Former German liners, converted merchantmen and warships operated by the Cruiser and Transport Force of the Atlantic fleet transported from Europe to the United States during June

a total of 315,067 troops, which is 9000 more than were transported to Europe by all vessels of the allied nations during any one month of the war, it was announced yesterday by Vice Admiral Albert Gleaves. This, it was stated, was in addition to troops carried by other agencies.

To handle these troops 136 ships were employed, all manned by navy officers and crews, included among them being the giant transports *Leviathan, Imperator, Kaiserin Auguste Victoria,* and other large ships taken over from the Central Powers. Leading all others in the handling of troops during June was the *Leviathan,* which has carried on the return voyage since the signing of the armistice a total of 76,422 men.

Some exceptional records in rapid "turn arounds" at Brest have been recorded. The record probably is held, however, by the transport *Great Northern,* which made a round trip in a trifle more than twelve days. Included in this time was the discharging at Brest of 5000 dozen eggs and 7000 tons of fruit and the taking on board for the return trip of 3130 passengers and troops, four lighters of baggage, 350 sacks of mail, 4000 barrels of oil, and 500 tons of sugar. The time spent at anchorage at Brest was five hours and ten minutes.—*N. Y. Times, 7/17.*

MILITARY HISTORY PRIZE.—The American Historical Association offers a prize of $250 for the best unpublished essay in American military history submitted to the Military History Prize Committee before July 1, 1920.

The essay may treat of any event of American military history,—a war, a campaign, a battle; the influence of a diplomatic or political situation upon military operations; an arm of the service; the fortunes of a particular command; a method of warfare historically treated; the career of a distinguished soldier. It should not be highly technical in character for the object of the contest is to extend the interest in American military history; but it must be a positive contribution to historical knowledge and the fruit of original research.

The essay is not expected to be less than ten thousand or more than one hundred thousand words in length.

It should be submitted in typewritten form, unsigned; and should be accompanied by a sealed envelope marked with its title and containing the name and address of the author; and a short biographical sketch.

Maps, diagrams or other illustrative materials accompanying a manuscript should bear the title of the essay.

The Committee, in reaching a decision, will consider not only research, accuracy and originality, but also clearness of expression and literary form. It reserves the right to withhold the award if no essay is submitted attaining the required degree of excellence.

For further information address the Chairman of the Military History Prize Committee, Milledge L. Bonham, Jr., Louisiana State University, Baton Rouge, Louisiana.

CURRENT NAVAL AND PROFESSIONAL PAPERS

The Future of American Shipping. By Edwin N. Hurley. *Universal Engineer,* April, 1919.

Peace—or Truce? 1. The Peace According to Versailles—1919. By George A. B. Dewar. 2. The Peace According to Herr Erzberger—1914. By George Saunders. 3. After the Signature. By Harold F. Wyatt. 4. War and Peace, Limited or Unlimited. By Major R. M. Johnston, U. S. A. *The Nineteenth Century and After,* July, 1919.

The Great Peace. By the Right Hon. Sir Joseph Compton-Rickett, M. P. *The Contemporary Review,* July, 1919.

The Liabilities of the Treaty. By Wm. Harbutt Dawson. *The Fortnightly Review,* July, 1919.

Japan, Yesterday, To-day and To-morrow? By Prof. Joseph H. Longford (late H. M. Consul, Nagasaki). *The Nineteenth Century and After,* July, 1919.

DIPLOMATIC NOTES

FROM JULY 18 TO AUGUST 18

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

TREATY RATIFICATION DELAYED

NO APPOINTMENT ON REPARATION COMMISSION.—On July 18, President Wilson wrote to Senator Lodge, Chairman of the Senate Committee on Foreign Relations, requesting approval of the temporary appointment of an American member to the Reparation Commission in Paris, pending ratification of the treaty. On the following day the Senate Committee passed a resolution to the effect that until the treaty was ratified no power existed to make the appointment.

PROPOSED ALTERATIONS OF LEAGUE COVENANT.—Consideration of the Peace Treaty in the Senate and the Senate Committee on Foreign Relations was directed almost entirely to the Covenant for a League of Nations. Objection centered chiefly upon the Shantung settlement, Articles X and XI, guaranteeing the territorial integrity of signatory states, and the clauses relating to withdrawal from the League and control of domestic affairs. Two general methods of conditional ratification were considered: (1) that of inserting "interpretations" giving a precise and acceptable meaning to clauses in dispute, but not requiring the approval of other powers; (2) that, favored by the more radical opponents of the League plan, of inserting reservations or amendments that would require acceptance by other nations.

President Taft, in a letter to the Chairman of the Republican National Committee made public on July 22, offered the following six "interpretations":

1. That upon two years' notice the United States could cease to be a member of the League without having the League pass upon whether she had fulfilled all her obligations under the covenant.
2. That self-governed colonies and dominions could not be represented on the League Council at the same time with the mother government, or be included in any of those clauses where the parties to the dispute are excluded from its settlement.
3. That the functioning of the Council under Article X shall be advisory only, and that each member shall be left free to determine questions of war in its own way, the decision of the United States resting with Congress.
4. That differences between the nations regarding immigration, the tariff, and other domestic questions shall not be left to the League for settlement.
5. That the Monroe Doctrine is to be reserved for administration by the United States.
6. That the United States reserves the right to withdraw unconditionally at the end of ten years, or at least to terminate then her obligations under Article X.

THE LODGE RESERVATIONS.—In a speech before the Senate on Aug. 12, Senator Lodge offered five reservations to be added to the League Covenant, and to have the practical effect of amendments. Senator Lodge suggested that these should be accepted by at least the four other great powers in the Council of the League. The proposals follow:

1. On Article 10, touching upon the guarantee of territorial integrity of nations in the League, so as to provide that Congress retain definitely the right to say when and where American soldiers are to fight. Under this reservation it would be impossible for the League to compel America to send forces into any conflict anywhere without the consent of Congress.

2. On Article 11, relating to the right of the Council to pass upon any emergency of "war or threat of war" and to recommend any action it deems "wise and effectual to safeguard the peace of the world." Under this Lodge reservation proposal any decision of the Council involving the use of American forces would be subject to the consent of Congress, as in the case of Article 10.

3. As to the Monroe Doctrine, stating plainly that it is not to be subject to interpretation or construction by the League Council.

4. On purely domestic questions, such as immigration, the tariff and racial matters, these all being reserved entirely for American determination.

5. On the two years' withdrawal clause, the United States Government, and not the League Council, to determine if America's obligations under the covenant have been fulfilled.—*N. Y. Times*, 13/7.

FRENCH TREATY SUBMITTED TO SENATE.—Complying with a request expressed in a Senate Resolution, President Wilson, on July 29, submitted to the Senate the text of the Proposed Treaty with France, and on August 11 the informal draft of a League of Nations covenant which was prepared by the American Peace Commission. The draft was found to conform closely to the actual Covenant, Article X on territorial integrity being practically identical.

OTHER NATIONS RATIFY PEACE TREATY.—The Peace Treaty, including the League of Nations Covenant and the Anglo-French defensive agreement were passed by the British House of Commons on July 21, and by the House of Lords on July 24. In the course of the debate in the House of Lords, Earl Curzon stated that it had not been finally decided that the trial of the ex-Kaiser would be held in England.

The Peace Treaty was ratified by the Belgian Chamber of Deputies on August 8, and by the Polish Parliament on July 31. Ratification was also recommended by the Peace Treaty Committee of the French Chamber of Deputies by a vote of 34 to 1. According to a Paris dispatch discussion of the Treaty in the French Chamber was scheduled to begin about August 26.

AUSTRIAN PEACE TERMS

Paris, July 20.—The full peace conditions of the Allied and Associated Powers are now in the hands of the Austrians.

In addition to the published summary of the terms of June 2, the new clauses provide for the reparation arrangements very similar to those in the treaty with Germany, including the establishment of an Austrian subsection of the Reparations Commission, the payment of a reasonable sum in cash, the issuing of bonds, and the delivery of livestock and certain historical and art documents.

The financial terms provide that the Austrian pre-war debt shall be apportioned among the former parts of Austria, and that the Austrian coinage and war bonds circulating in the separated territory shall be taken up by the new Governments and redeemed as they see fit.

Under the military terms the Austrian army is henceforth reduced to 30,000 men on a purely voluntary basis.—*N. Y. Times*, 21/6.

BULGARIAN PEACE SETTLEMENT

Paris dispatches of July 25 announced that the Bulgarian Peace Commissioners would arrive in Paris on the following day, that the Bulgarian Treaty was nearly completed, and that the reparation demanded of Bulgaria would be from $2,000,000,000 to $3,000,000,000.

The chief difficulty of the Balkan settlement lay in the disposition of Thrace, a name applied to the rich tobacco country lying east of Macedonia and south of Bulgaria on the Ægean Sea, inhabited by a mixed population, and claimed by both Bulgaria and Greece.

Paris, Aug. 8.—The solution arrived at, the *Intransigeant* says, provides for dividing Thrace into Eastern and Western Thrace. Eastern Thrace will be divided into three parts, Greece getting two of them and a third being designated as a part of the future free State of Constantinople.

Of Western Thrace, a quarter is to be given to Greece and the other three-quarters are to constitute a free State to be set up under the League of Nations.

A commission of technical experts will be sent to Thrace to put the solution into practical form, it is said.

According to the probable designation of Thrace and its projected partition, Bulgaria will be completely shut out from the Ægean Sea, on which she secured a coast line from the Mesta to the town of Enos, (about 80 miles,) in 1913, while Greece will secure the rich tobacco lands of the Kavala region already given her, however, by the Buchanan treaty. The future free State of Constantinople, on the east, will secure the Dedeaghatch railway and Maritza River system leading north to the junction with the Belgrade-Constantinople-Orient Railway at Adrianople.—*N. Y. Times*, 17/7.

JAPAN AND CHINA

JAPAN EXPLAINS POLICY.—Prompted by opposition in the United States and elsewhere to the terms of the Shantung settlement, Viscount Uchida, Japanese Minister of Foreign Affairs, issued on August 3 a statement to the effect that Japan was ready to hand back the Shantung Peninsula to China, retaining only the economic privileges formerly held by Germany, and to begin negotiations to that end "as soon as possible after the ratification of the Peace Treaty by Japan." He further stated that Tsingtao would be made a general foreign instead of an exclusively Japanese settlement, and that the Kiao-Chau-Tsinan-Fu Railway would be operated as a "joint Japanese-Chinese enterprise without any discrimination in treatment against the people of any nation." The statement reads:

It appears that, in spite of the official statement which the Japanese Delegation at Paris issued on May 5 last, and which I fully stated in an interview with the representatives of the press on May 17, Japan's policy respecting the Shantung question is little understood or appreciated abroad.

It will be remembered that in the ultimatum which the Japanese Government addressed to the German Government on Aug. 15, 1914, they demanded of Germany to deliver, on a date not later than Sept. 15, 1914, to the

imperial authorities, without condition of compensation, the entire leased territory of Kiao-Chau with a view to eventual restoration of the same to China. The terms of that demand have never elicited any protest on the part of China or any other Allied or Associated Powers.

Following the same line of policy, Japan now claims as one of the essential conditions of peace that the leased territory of Kiao-Chau should be surrendered to her without condition or compensation. At the same time abiding faithfully by the pledge which she gave to China in 1915, she is quite willing to restore to China the whole territory in question and to enter upon negotiations with the Government at Peking as to the arrangement necessary to give effect to that pledge as soon as possible after the treaty of Versailles shall have been ratified by Japan.

Nor has she any intention to retain or to claim any rights which affect the territorial sovereignty of China in the province of Shantung. The significance of the clause appearing in Baron Makino's statement of May 5, that the policy of Japan is to hand back the Shantung peninsula in full sovereignty to China, retaining only the economic privileges granted to Germany, must be clear to all.

Upon arrangement being arrived at between Japan and China for the restitution of Kiao-Chau, the Japanese troops at present guarding that territory and the Kiao-Chau-Tsinanfu Railway will be completely withdrawn.

The Kiao-Chau-Tsinanfu Railway is intended to be operated as a joint Sino-Japanese enterprise without any discrimination in treatment against the people of any nation.

The Japanese Government have, moreover, under contemplation proposals for the reestablishment in Tsingtao of a general foreign settlement, instead of the exclusive Japanese settlement which by the agreement of 1915 with China they are entitled to claim.—*N. Y. Times*, 7/7.

PRESIDENT WILSON'S COMMENT.—On August 6 President Wilson explained his position regarding the Shantung settlement, stating that it was clearly understood at Paris that the restoration of Chinese sovereignty should be in no way contingent upon China's execution of pledges made to Japan in 1915, as might be inferred from Viscount Uchida's statement. Furthermore, the acceptance of the Shantung settlement by the United States was not to be construed as acquiescence in the policy of Japan as expressed in the China-Japanese Notes of 1915 and 1918. The President's statement follows:

The government of the United States has noted with the greatest interest the frank statement made by Viscount Uchida with regard to Japan's future policy respecting Shantung. The statement ought to serve to remove many misunderstandings which had begun to accumulate about this question.

But there are references in the statement to an agreement entered into between Japan and China in 1915 which might be misleading if not commented upon in the light of what occurred in Paris when the clauses of the Treaty affecting Shantung were under discussion. I therefore take the liberty of supplementing Viscount Uchida's statement with the following:

In the conference of the 30th of April last, where this matter was brought to a conclusion among the heads of the principal Allied and Associated Powers, the Japanese delegates, Baron Makino and Viscount Chinda, in reply to a question put by myself, declared that:

The policy of Japan is to hand back the Shantung peninsula in full sovereignty to China, retaining only the economic privileges granted to Germany, and the right to establish a settlement under the usual conditions at Tsingtao.

The owners of the railway will use special police only to insure security for traffic. They will be used for no other purpose.

"The police forces will be composed of Chinese, and such Japanese instructors as the directors of the railway may select will be appointed by the Chinese Government."

No reference was made to this policy being in any way dependent upon the execution of the agreement of 1915 to which Count Uchida appears to have referred. Indeed, I felt it my duty to say that nothing that I agreed to must be construed as an acquiescence on the part of the government of the United States in the policy of the notes exchanged between China and Japan in 1915 and 1918, and reference was made in the discussion to the enforcement of the agreements of 1915 and 1918 only in case China failed to cooperate fully in carrying out the policy outlined in the statement of Baron Makino and Viscount Chinda.

I have, of course, no doubt that Viscount Uchida had been appraised of all of the particulars of the discussion in Paris, and I am not making this statement with the idea of correcting his, but only to throw a fuller light of clarification upon a situation which ought to be relieved of every shadow of obscurity or misapprehension.

WOODROW WILSON.

—*N. Y. Times, 7/7.*

WHAT CHINA WANTS.—To satisfy China and induce her to sign the German treaty, Japan must develop or amend her April 30 undertaking by fixing a definite date, not more than a year hence, within which she will restore the Chinese political rights. She must surrender military control of the railway, police, and agree that Kiao-Chau shall be open for international settlement and not held as a permanent, exclusive Japanese settlement.—*N. Y. Times, 3/7.*

HUNGARY

BELA KUN RÉGIME OVERTHROWN.—On July 26 the Allied delegates at Paris took definite action toward a settlement of the Hungarian situation by notifying Hungary that no negotiations would be undertaken with the government then in control. Threatened by the advance of Rumanian forces and unable to secure supplies from the Allied Powers, Bela Kun voluntarily resigned on July 31. With promises of assistance from Paris, a new cabinet was set up with Jules Peidll as Premier.

RUMANIAN TROOPS OCCUPY BUCHAREST.—On August 4 the Rumanian Army advanced to Bucharest without opposition, and some 30,000 troops entered and occupied the city and began seizing stores and munitions. Rumania presented an ultimatum to Hungary making demands for food supplies and reduction of the army far in excess of the Armistice conditions.

The advance of Rumanian forces was in defiance of a message sent by the Supreme Council at Paris on August 2 requesting that the Rumanian forces immediately cease their invasion of Hungarian territory. This note was followed by a sharp demand on August 6 that Rumania observe the terms of the Armistice. On August 12 the Allied Military Commission at the Hungarian capital informed Paris that the Rumanian High Commissioner refused to regard instructions from the Peace Conference as orders.

ARCHDUKE JOSEPH SEIZES POWER.—On August 6 the Peidll Cabinet was overthrown by a *coup d'état* and a new ministry set up under the Archduke Joseph.

News that the Archduke Joseph had set up a new Hungarian government quickly followed that of Peidll's overthrow. The Social Democrats of

Budapest managed to get their appeal through to Paris this afternoon begging the Peace Conference to save the country from both the Rumanians and the reactionary Archduke.

But the Conference is helplessly asking what it can do. The only comment on Archduke Joseph by one of the peacemakers was:

"I fear he has monarchial tendencies."

But that is about the only attempt any one has made at a joke on the present Balkan mess.

The American and British delegates in Paris are furious over the situation, at least as furious as plenipotentiaries ever allow themselves to get. The French, although impressed by the seriousness of the situation, cannot refrain from chuckling a little over the miscarriage of the Hungarian policy, which they disapproved from the start, because it did not agree with their desire to send a large military force, chiefly American, to Hungary. But the Italians are more frankly disturbed than anybody else by this coming to the front of Archduke Joseph. Italy's traditional fear and hatred of Austria-Hungary is associated only with the aristocracy of the old dual monarchy.

Peace Headquarters do not share Italy's fears in that direction. There is much more alarm that the overthrow of Peidll will soon lead to the recurrence of Bolshevism in Hungary, which the Allies thought they had got rid of with Bela Kun.

Regardless of the difference of opinions on various phases of the situation, the delegates in Paris are beginning to wonder if they would not have had an easier task restoring peace in Europe if they had left Austria-Hungary intact, as they might have done instead of cutting up and trying so many experiments at one time in setting up small and independent liberty-loving states.—*N. Y. Times*, 8/7.

FRANCE

CHAMBER SUPPORTS CLEMENCEAU.— Following the vote in the French Chamber of Deputies on July 18, which went against the Clemenceau Government and forced the resignation of Food Minister Boret, attacks on the government were renewed during the following week. On July 22 the Chamber gave the government a vote of confidence by a majority of 272 to 181 and on July 24 by a majority of 304 to 134. On the second occasion attacks were directed against Ministers of Finance Klotz and his policy. M. Klotz expressed faith in the ability of France to emerge from what he described as her difficult but not desperate financial straits.

RUSSIA

KOLCHAK GOVERNMENT THREATENED.—Press dispatches during the early part of August mingled reports of the collapse of Bolshevism and the resignation of Lenine with a record of military events of quite contrary significance. On August 1 it was reported that the morale of the Kolchak forces was low, that they had retreated 200 miles from their advanced lines, and later that the Omsk Government was preparing to remove to Irkutsk, Siberia, a distance of about 600 miles.

Ambassador Morris's Report.—Washington, August 11.—Complete collapse of the Kolchak movement in Siberia was forecast in reports reaching Washington to-day. Kolchak forces have fallen back almost 200 miles from their former advanced lines and Omsk was said to be threatened with evacuation.

Failure of the Allied and Associated Governments to get adequate supplies to Admiral Kolchak, the advices said, had forced him to fall back steadily before the greatly superior Bolsheviki forces composed of veterans,

whose officers include many Germans who fled to Russia when the Armistice was signed.

Officials here are known to regard Kolchak's efforts at an end unless most radical measures are adopted by outside governments and it was suggested that the President might call the attention of Congress to the imminence of Bolshevik control of all Serbia.

The proposition of extending aid to Admiral Kolchak received the support of President Wilson and his associates at the Peace Conference in Paris, but the getting of supplies to him was found to be more of a military than a diplomatic problem.

France, England, and Japan were in position politically to offer supplies, but the position of the United States was not so clear on that point. Some officials in Washington held that for the United States to participate in any extensive support either in supplying the forces or in adding man-power to the army, congressional action would be necessary.—*N. Y. Herald*, 12/7.

MEXICO

BAN ON ARMS EXPORTS.—President Wilson on July 22 issued a proclamation prohibiting the export of arms and munitions to Mexico, on the ground that a state of domestic violence existed in Mexico warranting such action as provided by an act of Congress.

SENATE INVESTIGATES MEXICAN RELATIONS.—During the latter part of July Congress entered upon preliminary examination of the Mexican situation with a view to the appointment of a special investigating committee. Mr. Henry P. Fletcher, American Ambassador to Mexico, in testimony before the House Rules Committee on July 22, presented a list of 217 Americans killed by Mexicans, 137 since the Carranza régime, with no evidence, in the great majority of cases, that arrests or adequate reparation had been made.

The Senate Foreign Relations Committee on August 8 appointed a special committee composed of Senators Fall, Smith of Arizona, and Brandagee, to make an investigation. Senator King, who offered the resolution creating the committee, proposed the following program:

A thorough investigation to uncover the true situation in Mexico, followed by:

A peremptory demand by this government for the immediate adoption and enforcement by Mexico of measures for the protection of American citizens and interests in Mexico, all confiscated or looted property to be returned at once.

Reparation to be immediately assured for all classes of damages sustained, whether through loss of life or through seizure or destruction of property.

Creation of a commission to determine the exact measure of all damages. Senator King suggests a commission of one American, one Mexican and one neutral, or if preferable, a commission of five neutrals.

Negotiation of a treaty providing for Mexican liquidation of the bill as determined by such a commission. In event of failure on Mexico's part a prompt blockade of Mexican ports and administration of the customs until the damages are liquidated.

"It is impossible to estimate the amount of damages that Americans will claim," said Senator King. "Fully ten thousand Americans from Utah and Arizona have been driven out of Mexico and have damage claims. Some run up to $150,000 or even $200,000. These are entirely aside from indemnities for lives lost. They likewise do not include the damages sustained by mining, railroad, oil, sugar, and other big plantation concerns and the like. The aggregate of damage claims will be from $200,000,000 to $500,000,000 and perhaps still larger."—*N. Y. Times*, 11/7.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"A Report On Medical and Surgical Developments of the War." By William Seaman Bainbridge, Lieut. Commander, Medical Corps, U. S. N. R. F.

A special number of the U. S. Naval Medical Bulletin, January, 1919, comprises this report. The author in his foreword states that the observations were made on the Western Front and in England during December, 1917, and the first six months of 1918, with added data obtained in Germany during the Autumn of 1915. The object of the survey was to record the surgical lessons of the present war, based on the experience of the Allies, for the benefit of the medical officers and hospital corpsmen on active service. Recognizing the temptation to go into detail, with such a wealth of material gathered, the author has satisfactorily adhered to the presentation of the principal points which have a practical bearing on the questions involved. As a trained surgeon of experience he was in a position to know what to look for and decide what would be of value.

The first portion of the report considers the treatment of war wounds by the Allies and the great variation of methods. The two extremes of the use of strong antiseptics or practically no antiseptics are fairly presented, with a chronological study of the evolution of treatment in the present war. The question of immediate, delayed and secondary wound suture is thoroughly discussed. Considerable space is given to the details of the Carrel-Dakin treatment which has its enthusiastic advocates as well as bitter critics. The results claimed by Carrel are "diminution in the frequency and intensity of general complications; diminution in the number of amputations; diminution in the length and cost of treatment." Those who condemn the use of all antiseptics state, "they damage still further the injured tissues and contribute nothing to the healing process or the prevention of infection." The author accepts the judgment of a number of surgeons "that while most of the methods have definite fields of usefulness, none of them is a panacea." The various other antiseptics, their method of preparation and use, are given in detail, with comments by those who advocate them. These include eusol; eupad; salt pack; dichromanine "T"; magnesium sulphate; "bipp"; flavine; crystal violet and brilliant green; hypertonic solutions; sunlight treatment; phenolisation and embalmment of septic war wounds; electricity, oxygen and ozone.

Owing to the German method of disregarding humane principles by systematic efforts to prevent leakage of information relating to military medicine and surgery, the author found it difficult to make deductions from

all he saw and heard while in that country. No one method of controlling wound infection was in use, but irrigation with hydrogen peroxide was extensively practiced in the German military hospitals. Vaccinations were used for small-pox and enteric fever. Well equipped hospitals were visited where considerable attention was given to the mental state of the patient on the principle that "the more hope and courage the better the healing and shorter the convalescence." Also the after care of the wounded soldier was emphasized with a view of returning him to the ranks, if possible, or making him self-supporting.

Among the developments of modern war-surgery has been the demonstration of the close relation between anesthesia and the extent of mortality and morbidity. "Giving the wrong anesthetic or giving the right anesthetic wrongly." As a result of experience new methods have been devised and old methods improved upon. The author discusses local and regional anesthesia; gas and oxygen, oral anesthesia, spinal anesthesia, and rectal anesthesia.

New methods of treating joint lesions and fractures have been found to obviate the necessity of amputation in many cases. C. Williams of the Belgian Military Hospital at Hoogstade has done some remarkable work that the author considers important enough to warrant the report in full of his technique. Special hospitals for fracture cases have been found necessary in order that the best treatment be assured. Certain surgeons have developed new methods which the author discusses, such as Sinclair's method of treating fractures; Willens Screw Extension Apparatus; and the apparatus of Le Clercq and Varigard.

A difficult class of cases to treat have been the trephined ones. Prof. Babinski, the leading neurologist in France, gave as his opinion of treatment for trephined patients with symptoms—"do a cranioplastic operation but do not promise too much." The use of cartilaginous grafts to repair the gap left in the skull has given good results.

War surgery always involves amputations, and in the early days of the present war there were many unnecessarily done. Better methods of treating wounds, joints and fractures have resulted in a great saving of limbs. The opinions of the leading surgeons as to the best type of amputations for the use of artificial limbs is discussed.

Plastic surgery has been one of the great developments of the war, but we must not forget the advances made in this field for the past 25 years. The ancient Hindoos were credited with performing plastic operations 2000 years ago. Restorative surgery, such as bone grafting, nerve suture, tendon transplanting, etc., has been gratifying, but the most remarkable results have been obtained in plastic surgery of the face and jaw, owing to the cooperative work between the surgeon and dentist. The author describes the work and methods used at the leading reconstruction hospitals he visited.

Trench fever has been one of the great problems of the war. The author discusses the symptomatology and measures to prevent its occurrence, especially the destruction of the louse which was found to transmit it.

The problem of evacuation of wounded from the firing line to convalescent camp, as handled by the British, is set forth at length. This includes the surgery of the forward area and transportation from the trenches to regimental aid post, advanced dressing station, field ambulance, walking wounded post, main dressing station, casualty clearing station, ambulance train, stationary hospital, ambulance transport to England, ambulance train to base or special hospitals, and finally to convalescent camps. Experience has shown the degree of surgical procedure that may be adopted at each station. Special notes of hospitals visited and surgical methods in use are given in detail. The organization, administration, and results accomplished by convalescent camps are also discussed. The author states that France and Britain early in the war recognized their responsibility for the re-education of the disabled and we should learn from them and Belgium the lessons that four years of experience have taught. Functional re-education should begin in the hospital before the wound is healed or before habits are formed conducive to permanent helplessness and reliance on others. Functional re-education by work has proved to be the most helpful, although gymnastics and special machines are useful. Vocational re-education gives a man an opportunity to learn some other trade or profession which will enable him to be self-supporting. In Europe, almost from the beginning of the war, this has been recognized and special institutions provided, some of which the author describes.

For the purpose of comparing methods and results in war surgery the American Red Cross, through Major Alexander Lambert, organized a research society which meets monthly in Paris and publishes its proceedings in a journal. The general principles guiding the treatment of wounds of war and the best accepted methods for each class are outlined.

In completing his report the author discusses miscellaneous subjects, such as the modern treatment of burns by ambrine; suggests plans for an evacuation hospital; gives a proposed organization of educational service in war surgery; and offers special suggestions regarding disposal of U. S. Army casualties.

Finally, as a result of his survey, the author makes several recommendations which he believes may be helpful. Medical officers should read this excellent report in full, as it is worth careful study.

D. N. C.

More members, both regular and associate, are much desired. Any increase in membership invariably means larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

S. A. Taffinder,
Secretary-Treasurer.

Attention is invited to extracts from the constitution on the opposite page as to the requirements in making applications for life, regular and associate membership. Members and associate members are liable for the payment of the annual dues until the date of the receipt of their resignation in writing. Annual dues $2.50.

....

....*191*

To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a $\left\{\begin{matrix}\textit{regular}\\ \textit{associate}\end{matrix}\right\}$ *member of the U. S. Naval Institute from this date.*

Very truly yours,

....

....

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio,* an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the United States Naval Institute Proceedings, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the Proceedings, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The Proceedings are published monthly; subscription for non-members, $3.00; enlisted men, U. S. Navy, $2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

S. A. TAFFINDER,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887

The Naval Brigade: Its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888

Torpedoes. Prize Essay, 1888. By Lieut. Commander W. W. Reisinger, U. S. N.

1891

The Enlistment, Training and Organization of Crews for Our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892

Torpedo-boats: Their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894

The U. S. S. Vesuvius, with Special Reference to Her Pneumatic Battery. Prize Essay, 1894. By Lieut. Commander Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut. Commander Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention 1896. By Lieutenant John M. Ellicott, U. S. N.

1897

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut. Commander Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903

Gunnery in Our Navy. The Causes of Its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure Its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905

American Naval Policy. Prize, Essay 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear Admiral Stephen B. Luce, U. S. N.

1906

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut. Commander A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906 By Pay Inspector J. A. Mudd. U. S. N.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A Few Thoughts on Our Next Step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut. Commander Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENCE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut. Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotton, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut. Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut. Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut. Commander Dudley W. Knox, U. S. N.

1914

The Great Lesson from Nelson for To-day. Prize Essay, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

NAVAL POLICY AS IT RELATES TO THE SHORE ESTABLISHMENT AND THE MAINTENANCE OF THE FLEET. Honorable Mention, 1914. By Captain John Hood, U. S. N.

OLD PRINCIPLES AND MODERN APPLICATIONS. Honorable Mention, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

MILITARY PREPAREDNESS. Honorable Mention, 1914. By Naval Constructor Richard D. Gatewood, U. S. N.

1915

The Rôle of Doctrine in Naval Warfare. Prize Essay, 1915. By Lieut. Commander Dudley W. Knox, U. S. N.

AN AIR FLEET: OUR PRESSING NAVAL WANT. First Honorable Mention, 1915. By Lieut. Commander Thomas Drayton Parker, U. S. N.

TACTICS. Second Honorable Mention, 1915. By Ensign H. H. Frost, U. S. N.

DEFENCE AGAINST SURPRISE TORPEDO ATTACK. Third Honorable Mention, 1915. By Ensign R. T. Merrill, 2d, U. S. N.

1916

The Moral Factor in War. Prize Essay, 1916. By Lieutenant (J. G.) H. H. Frost, U. S. N.

NAVAL PERSONNEL. First Honorable Mention, 1916. By Lieut. Commander J. K. Taussig, U. S. N.

EDUCATION AT THE U. S. NAVAL ACADEMY. Second Honorable Mention, 1916. By Lieutenant Ridgely Hunt, U. S. N.

SOME UNDERLYING PRINCIPLES OF MORALE. Third Honorable Mention, 1916. By Commander Dudley W. Knox, U. S. N.

LARGE *vs.* A GREATER NUMBER OF SMALLER BATTLESHIPS. Lippincott Prize Essay. By Lieut. Commander Thomas Lee Johnson, U. S. N.

1917

Commerce Destroying in War. Prize Essay, 1917. By Commander Lyman A. Cotten, U. S. Navy.

THE PEOPLE'S RÔLE IN WAR. First Honorable Mention, 1917. By Lieutenant H. H. Frost, U. S. Navy.

THE NATION'S GREATEST NEED. Second Honorable Mention, 1917. By Colonel Dion Williams, U. S. Marine Corps.

1918

Letters on Naval Tactics. Prize Essay, 1918. By Lieutenant H. H. Frost, U. S. N.

THE PREPAREDNESS OF THE FUTURE. First Honorable mention, 1918. By Commander H. O. Rittenhouse, U. S. N. Retired.

NAVAL STRATEGY. Second Honorable Mention, 1918. By Rear Admiral Bradley A. Fiske, U. S. N.

1919

MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.

SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

. 45 OCTOBER 1919 No. 200

United States Naval Institute Proceedings

The writers only are responsible for the contents of their respective articles

CONTENTS

Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 10 October, 1919 Whole No. 200

United States Naval Institute
Proceedings

PUBLISHED MONTHLY
EDITED BY S. A. TAFFINDER

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

CONTENTS

OFFICERS OF THE INSTITUTE

President

Rear Admiral BRADLEY A. FISKE, U. S. Navy

Vice-President

Rear Admiral A. H. SCALES, U. S. Navy

Secretary and Treasurer

Commander S. A. TAFFINDER, U. S. Navy

Board of Control

Captain W. T. CLUVERIUS, U. S. Navy
Captain T. L. JOHNSON, U. S. Navy
Captain E. J. KING, U. S. Navy
Captain W. G. DU BOSE, Construction Corps, U. S. Navy
Commander S. A. TAFFINDER, U. S. Navy (*ex officio*)

PAST PRESIDENTS

OF THE

U. S. NAVAL INSTITUTE

ADMIRAL DAVID D. PORTER, U. S. NAVY, 1873
REAR ADMIRAL JOHN L. WORDEN, U. S. NAVY, 1874
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1875–JAN. 1878
COMMODORE FOXHALL A. PARKER, U. S. NAVY, JAN. 1878–JAN. 1879
REAR ADMIRAL JOHN RODGERS, U. S. NAVY, JAN. 1879–JAN. 1882
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1882–JAN. 1883
REAR ADMIRAL THORNTON A. JENKINS, U. S. NAVY, JAN. 1883–OCT. 1885
REAR ADMIRAL EDWARD SIMPSON, U. S. NAVY, OCT. 1885–OCT. 1887
REAR ADMIRAL STEPHEN B. LUCE, U. S. NAVY, OCT. 1887–OCT. 1898
REAR ADMIRAL WM. T. SAMPSON, U. S. NAVY, OCT. 1898–OCT. 1902
REAR ADMIRAL H. C. TAYLOR, U. S. NAVY, OCT. 1902–OCT. 1904
REAR ADMIRAL C. F. GOODRICH, U. S. NAVY, OCT. 1904–OCT. 1909
REAR ADMIRAL RICHARD WAINWRIGHT, U. S. NAVY, OCT. 1909–OCT. 1911

SHIP *BETHEL*, OF BOSTON, 14 GUNS, LETTER OF MARQUE, ISAAC FREEMAN, MASTER.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. 45, No. 10 OCTOBER, 1919 Whole No. 200

OFFICER PERSONNEL OF THE NAVY

RETROSPECTIVE AND PROSPECTIVE

By Captain Harris Laning, U. S. Navy

It is doubtful if among its sins of omission and commission the United States has any that is more glaring from a naval point of view than its neglect to provide in time of peace sufficient properly trained personnel to man and operate its fleets in war. Year after year we have seen the navy grow in a material way and to some extent the personnel has been increased, but there has never been any relation between the material increases and the increases of personnel. Even in the increases in personnel those pertaining to officers have progressed much less favorably, than those for enlisted men, the climax of the situation being reached about the time we declared war with Germany.

The fundamental reason for our lack of provision for personnel lies largely in our not having clear-cut national policies. With clear-cut national policies we could determine with considerable exactitude what military and naval strength we require to support them, and knowing that strength the personnel required for it would not only be easily determined but also would certainly be provided. As things are our naval strength is always a matter of chance, subject to the moods of a Congress that has no actual national policy to sustain and therefore cannot possibly know the needs of a navy required to sustain it.

Strange as it may seem the country at large and even Congress counts our naval strength in ships without considering for a moment whether or not the ships we have built or are building can be manned. The country is fed up by the press on the number of ships we have in the various classes and naturally believes that those ships are each and every one ready for war service. The people little realize that while billions have been spent for ships, insufficient laws have been made to provide the personnel to fight them and the necessary millions have not been appropriated to pay for the personnel that is just as necessary as ships, if ships are to fight.

The navy is not without blame for allowing this condition to come about. We ourselves have not advocated personnel as strongly as we have advocated material. When building programs were recommended practically nothing was mentioned about personnel yet the two recommendations should have gone hand in hand because each is worthless without the other. This attitude on the part of the navy was probably born of a desire to not ask for too large appropriations. In the cry for economy we have been afraid to insist on the great additional expense of commensurate personnel. We thought that having ships the personnel must necessarily be provided, but Congress finding that it could get credit for providing a large navy by merely providing ships was content to let it go at that and the matter not being forced to their attention it seems probable that they have not really understood the situation.

So long has the navy kept the personnel side in the background that now it is almost impossible to have legislators see it in its true light. The whole cry has been ships until the navy has come to mean only ships, and now that the Bureau of Navigation is striving to bring the personnel strength up to our ship strength they are finding it very difficult to get attention and still more difficult to get action on the navy's most vital need. The fact that the navy efficiently performed the part in the war it was called on to perform has kept alive the idea that all was well with us and that no change from old conditions is necessary. It is not generally understood that there might have been a different result had we been called on actually to fight from the very start.

It is one part of our preparation to have material but the vital thing is to have the trained personnel to get the maximum efficiency

from that material. As a matter of fact, of the two, personnel is the more vital for it is only by the personnel becoming skilled in naval warfare that they are able to determine what material is needed. The sound way to develop our navy is to supply personnel for the material we now have and then require the personnel to use the material and practice not only gunnery and engineering but also the strategy and tactics of naval warfare on a modern scale. As the personnel practices and trains in war games, maneuvers, gunnery, etc., it will ascertain the defects in material and methods; it will develop gunnery and engineering; it will suggest changes in types of craft; it will know the numbers of the various types required for a properly balanced fleet. Being skilled in strategy and tactics it will not advocate one type of ship to the exclusion of others but will advocate and get the proper number of each type; and as it progresses in the knowledge of naval war it will develop new material to meet new conditions that arise as we become more and more expert.

We have not a well-balanced navy to-day. Our battle line is good, and our destroyer force is large, but eyes and ears we have none and it is hard to see how we can get big results with what we have because our security and information service is so weak. And the reason it is weak is because of lack of personnel. Instead of having personnel versed in the use of all types of naval craft we have personnel versed only in the types we have been able to man. Being short in personnel what we have is overworked on their individual tasks and has very little time to study the broad problems of the navy. The result is that our broad problems do not receive the attention they should have. We have concentrated on gunnery and engineering, which are of course fundamental and vital, and we must continue to keep them on their present high planes, but we have not developed our strategy or tactics and our failure to do so has resulted in our not fully appreciating the necessity of having ships of all types and in the quantity we should have. We ourselves have not known and insisted on these types. What we have concentrated on we have developed wonderfully well, but continuing to do well in these things we must still go in for the development of the navy as a whole, never forgetting for one instant that as we develop our material we must also develop our personnel.

Not only have we been handicapped in the proper development of the navy as a whole by our lack of personnel in the past, but also we have not acquired the efficiency in the ships we have manned that we should have had. As we see the situation to-day we have not been fully ready either for peace or for war time operations. It was so essential to keep up the semblance of *fighting* strength that in the years just prior to the war we concentrated our personnel on battleships and destroyers and then spread it so thinly in order to man more ships that even the ships of those classes that we did man were not in all respects ready for war—at least not ready for war under the conditions it is waged to-day. We camouflaged our condition by calling the complements we gave them "peace complements" but at the same time we had no provision for changing those complements to "war complements." We *now* know that our so-called "peace complements" could not hope to fight those ships in an efficient manner because a ship's fighting team must be complete and every man in it fully trained long before war is declared. We can as sensibly train eight men for a foot ball team and increase the number to eleven the day of the big game as we can train a "peace complement" and increase it to a "war complement" at the time of battle. We would not run the risk of losing a sporting event by any such foolish action but we have and did run the risk of *national disaster* by just that same foolishness. In fact the conditions have been so bad in the last few years that we were not ready even to protect the national interests or even to show the flag in comparatively minor emergencies because in order incompletely to man *some* of our best fighting types we had to leave our gun boats, cruisers, etc., unmanned.

The effects of insufficient personnel are more far reaching than I can go into in this paper, but there are two branches of our naval effort that practically failed of development because of it. These are the submarine and aviation branches. Both the submarine and aeroplane are American inventions and each has come to be a vital factor in naval warfare, but while we led in inventing these marvelous machines we have only been straggling followers in using them for war purposes because we never could spare personnel in sufficient numbers to develop them. Had we had the personnel for those branches their developent by our navy would have been certain but as it was we got nowhere with them and it was our enemy who used our inventions most successfully in this war.

When war was declared, the situation we were in with regard to personnel, both men and officers, was truly deplorable. Not only were we lacking some of the vital types of ships, but what we had were not manned to fight to their maximum power. Both conditions were the indirect or direct result of the personnel situation, the former because our scant personnel was too overworked to ascertain and insist on all the types of ships needed, the latter because we tried to man more ships than our number would allow us to man. At the same time that the war started, a tremendous increase in material came to us. Thousands of enlisted men came in and had to be trained, and shore activity multiplied over and over again. Each required officers and there were none available. When we actually needed about 7000 line officers trained in all phases of modern naval warfare we had only 2394, and of these the number that had prepared themselves to handle *big* war problems was small. It was difficult to get the officers who were fully trained for *high command,* but infinitely more difficult to supply trained officers for subordinate places. Officers for high command duties did exist, but the thousands of trained officers needed in subordinate positions did not. *They* had to be created.

Fortunately for the United States the fighting did not come to this side. Had it done so when the war first started we would have been in a precarious condition. We could get along with the officers we had for the top places, but we had only enough officers to supply the "top" personnel. There was almost none for the bottom places. At that time the Bureau of Navigation had a momentous decision to make. The Office of the Chief of Naval Operations was making plans for a naval war on a large scale and the material bureaus began to turn out material for those plans in enormous amounts. Personnel to use it did not exist, but still the plans progressed and the material came on—transports, sub-chasers, destroyers, yachts, trawlers, submarines, aeroplanes, dirigibles, listening devices, guns, mines and so on *ad infinitum.* The material was good and all was needed for use against the enemy but it all called for trained men and officers that were not at hand.

The decision the Bureau of Navigation had to make was whether it would make it the policy to man merely what it had the personnel ready for or would adopt a plan to manufacture personnel as the material was manufactured and to finally supply

personnel for everything that came forth. If we limited ourselves to what we could man with the personnel we had, our part in the war would have been small but if we could find a way to man all that could be turned out we would ultimately have a navy of overwhelming power. Had the enemy been at our doors we would have been forced to adopt the smaller of the policies. The enemy, however, had a weakness and that was his inability to bring the fighting to us or to our coast. The Bureau taking advantage of that weakness and trusting in our allies to continue to hold the enemy, decided to adopt the policy of doing the big thing and finally to have personnel for that huge naval force that would certainly crush the Hun.

The Bureau's plan as adopted was to man efficiently all the craft we sent to the war zone, even at the expense of heavier craft remaining over here, and to train officers as fast as possible to fill the vacancies on ships not at the front. It made it a policy to rob ships that would not be fighting very soon to supply personnel for those that would. Craft to drive down the submarines, to transport troops, to protect convoys, etc., were in urgent demand and such craft were put in service at once and were well manned, but the battleships and other types that were not immediately needed were stripped of trained officers. Everywhere on shore and at sea intensive training of "officer material" was started and when it became known throughout the service that our ability to fight with our full strength was dependent on the success of that training, and that until every ship or station had trained up officers to fill its vacancies it would be valueless, the navy made up its mind to make that training a success and did make it so.

You who read this article are more or less familiar with the details of the training, development, and assignment of the thousands of officers the navy made during the war under that plan. The work of training and developing was trying and often nerve-racking, especially as it had to be carried on at the same time as the arduous work of war operations, but it was well done and ultimately, though many months after the war started, the navy had enough officers to permit it to fight to its maximum strength. It must not be supposed, however, that merely "enough officers" meets the navy's need. "Enough officers" made it possible for us to fight, but they are not the all-around officers we should have to develop and build up a navy. They are officers who can become

all-around officers in time and some have done so. As a rule, the duties these young and new officers could perform efficiently were limited, but because they learned to perform those limited duties well, the navy at last became ready to fight.

The war is now over and the personnel that came in for it is almost entirely gone. Thousands of the young men who came to us and who have been trained for officers have left us. There were many who were willing to stay in the navy and these with many others could have stayed with us to the great advantage of the navy and country. The navy needs officers and needs them by the thousands. We have to-day only about 2900 officers permanently commissioned in the line while for the permanent "authorized strength" alone we require 5499 permanent officers. However, the permanent authorized strength is altogether too small to man properly the number of ships the Chief of Naval Operations wants to keep manned in the future. For the first time that we can recall, the Bureau of Navigation has been given the number of ships that it is desirable to keep in commission. Heretofore the Bureau has merely manned what it could—now it is told how many ships of each type it must man. This at last gives the Bureau a plan to work on and the problem is definitely before it. To man those ships as they should be manned calls for a permanent authorized strength of 217,000 men and the line officers to go with them, 4 per cent of 217,000, a total of 8680 officers of the line. Actually the bureau finds that we should have 8716 line officers for the ships to be manned at this time, but as before stated we have less than 3000 permanent commissioned officers to meet that demand.

In making an estimate of this deficit of officers and in reaching a decision as to what it should do to meet it, the Bureau of Navigation realized that to wait until the Naval Academy could increase the number of officers by about 6000 might prove fatal. Even with the present large classes we cannot get from the academy a *net gain* of 400 per year. It will take the academy at least sixteen years to fill our *present* shortage, and any appreciable growth in the navy in that time will delay it by that much. Even the present three year building program was not considered in the above shortage, nor was any new building program given consideration. As a matter of fact, it appears to the Bureau that with the academy working to capacity at least 20 years must elapse before our navy

will have adequate officer personnel if we depend on the academy alone to supply the shortage.

The bureau felt that it would be neither wise nor safe to postpone our readiness for so long and has sought ways to provide immediately sufficient officers to keep the navy ready to fight if it should be called on. Excepting the academy there is only one source of supply quickly available and that source is the temporary and reserve officers trained during the war. The Bureau quite realizes that such officers have not acquired *all* the naval knowledge that academy officers have, but they can become very good officers, for all that, and certainly could tide us over another emergency as they have the present one.

Unless it has many more officers than it now has, the navy will not be ready to fight for years. By taking in a sufficient number from those temporarily with us during the war, we can keep fairly ready for war, and it is essential that we keep ready, for it is not likely that the next war will give us an ally that can hold the enemy off while we take time to build up our personnel. It is evident that we should obtain permanently for the service a goodly number of the officers who have already been trained at such effort and cost and the Bureau therefore decided to make the effort to get as many from the temporary and reserve officers as possible.

Prior to the adjournment of the last Congress on the 4th of March, the bureau officers went before it and stated the navy's case as to personnel. It was explained how 217,000 men are required for the navy's permanent strength if the Chief of Naval Operations plans, as to ships manned are carried out. It was shown that for his plans 8716 line officers are required. The Bureau submitted carefully drawn legislation, whereby the navy would have that permanent strength of 217,000 and whereby reserve officers who would otherwise be released when the national emergency ceases to exist, and temporary officers who would otherwise go out six months after the treaty of peace was signed, could be retained indefinitely, with their own consent, thus giving them ample time to prepare and qualify for permanent commissions. The proposed legislation further provided that the reserve and temporary officers, if they qualified by examination, could be permanently commissioned in the navy in the same *relative* standing they then held. The number that could come in under the Bureau's legislation was purposely not fixed further than it could

not exceed the number allowed for the authorized strength. Th Bureau wanted all to come in that could qualify, well realizin that at best we would not get anything like the number neede and that the Naval Academy would still continue to be taxed fo many years to bring the officer personnel of the navy up to th strength required to keep its material efficient and ready for wa

The legislation proposed by the Bureau is very broad in it scope. It applies to all corps and will permit each to take its quali fied officers in permanently. It will not restrict any officers fro coming in provided they can qualify. While no specific mentio was made of it, the suggested legislation provided for the future o aviation in the navy since it will permit the Naval Reserve Flyin corps, or class 5 of the Naval Reserve Force, to qualify and becom officers of the regular line. The Bureau of Navigation is of th opinion that unless the regular line of the navy develops aer nautics just as it develops submarines, destroyers, or any othe naval weapon there will be no real naval aviation. Officers in *nav* aviation must primarily be naval officers, and naval officers if the are to develop, operate, and use all the weapons at their dispos must have a knowledge of aviation as well as a knowledge o surface and subsurface craft. Aviation has placed at the navy disposal another weapon to be co-ordinated with our older weapo and unless we are to repeat our submarine failure of the past w must recognize and develop the new weapon given us by aviatio

It has been said that aviation is a specialty, but so is the opera tion of every other weapon we use and we must know the strateg and tactics as well as the capabilities and limitations of all ot weapons although we may not specialize in each of them. Nav aviation development of the future, and naval aviation craft wit their tactics and strategy of to-day, are bound up inseparably wit our other naval types and until we officers realize that aviation merely a new member of the naval team, to be developed an used with the other members, we will get nowhere with it. It ma be that fighting air craft will spell the doom of surface and sub surface fighting craft, but to do so the air craft personnel mu know surface craft strategy and tactics to be able to combat the and possibly defeat them. On the other hand the surface cra personnel must know air craft strategy and tactics or lose th benefits to be derived from the greatest invention of mode warfare.

The naval bill as it passed the House, prior to the adjournment of March 4, did not give us the personnel legislation the Bureau of Navigation asked for, so when that bill went to the Senate the Secretary of the Navy asked that the Bureau's ideas be, in general, adopted excepting in regard to the total *authorized* strength, which instead of being set at 217,000 was to be left at its present permanent strength of 131,000, but increased *temporarily*, until July 1, 1920, to 250,000. The bill as reported to the Senate by the naval committee largely followed those ideas. In the Senate bill, the *permanent* authorized strength was not increased but remained at 131,485 plus 6000 apprentices and firemen under training. This would have permitted us, when we could get them, to have only 5499 permanent line officers. The temporary enlisted strength to be retained until June 30, 1920, was set at 250,000, but officers, permanent and temporary combined, were limited by the terms of the bill to the number required for 181,485 or a *total* of only 7259 officers, of whom at least 2000 were to be "temporary officers." There is already a law providing that in time of peace reserve officers who have been confirmed in their rank may with their own consent be employed afloat, and such officers can be utilized to cover the deficiency in officers between the number allowed for 181,485 and the number required for 250,000 men, should the Senate bill ever become a law.

The great difference between the Bureau's legislation and that finally reported by the Senate Committee lies in the number of officers that can come permanently into the line. As previously stated the Bureau asked that all be commissioned who could qualify. The House limited the number to 700 and specified how many were to come in *in each grade*. *Limiting* the number that can come in makes coming in permanently a matter of competition and the adding of a clause specifying the number that can come in *in each grade* made the law practically impossible to carry out. The Senate Committee continued the number of officers that could come in at 700 but bettered matters somewhat by cutting out the part specifying the number that were to come in in each grade. The Senate Committee also made two specific additions; *first,* one allowing chief warrant officers of 15 years' service to be commissioned without examination in their present relative temporary position (which will add 388 to the 700 officers that can come in) and *second,* specifically authorizing the taking in, in the

permanent line of the navy, of 500 officers of the Naval Reserve Flying Corps, provided they qualify for line duties. If the personnel bill that is ultimately passed takes the form of the bill proposed by the Senate Committee during the last session, we will get all told, from temporary and reserve officers, some 1588 additional permanent commissioned line officers. That number is of course utterly insufficient to meet our huge shortage but it is decidedly better than what the House bill provided. While it will do a great deal for aviation it will leave the navy inadequately officered in other branches for many years, but it would be at least a step in the right direction.

Assuming the ultimate passage of legislation similar to that reported to the Senate by the Senate Naval Committee during the last session, the following will result:

1. With the chief warrant officers legislated into the commissioned line, we will, immediately upon the bill's passage, gain 388 permanent officers, and these should make 4 new permanent rear admirals, 19 new permanent captains, 50 new permanent commanders, and 107 new permanent lieutenant commanders.

2. If the 700 line duty officers and 500 aviation officers get permanent commissions further permanent promotions will result as follows: Rear admiral, 12; captains, 60; commanders, 156; lieutenant commanders, 324. These promotions would not come in a lump, but would probably be distributed over a considerable time dependent on the rate in which officers qualify for and obtain permanent commissions in the regular establishment.

3. Since there is no increase in the "permanent strength" of the navy, since the number of officers permanent and temporary in the grades of commander and above is based on the permanent strength, and since the upper grades are already filled by temporary promotions to the number allowed for that permanent strength, further temporary promotions to those grades will come only when vacancies occur by retirement or death.

4. Additional temporary promotions will come in the grade of lieutenant commander and below in proportion to the additional number of officers permanent and temporary we take in. Additional temporary officers may be appointed from the naval reserve force to fill the temporary vacancies created by the bill. If they are appointed it will give us in all 7259 officers, in the line of whom 3171 will be temporaries and these will serve only until June 30, 1920, unless by that time a new law is passed.

5. For retired officers of the grade of lieutenant commander and above who served but were not promoted during the war, provision is made for a promotion to the next higher grade upon recommendation therefor by a board of five flag officers appointed for that purpose.

While the legislation reported by the Senate Committee will not give us that permanency in officer personnel the situation demands, it will give us, provided the reserve officers will accept temporary commissions, sufficient officers to properly operate the navy until July 1 next year. It would be infinitely better to legislate for the future on a sound and permanent basis, but apparently there is no willingness to do so at this time. The Senate legislation would help the present situation only to the extent we could persuade temporary and reserve officers to accept permanent commissions and other reserve officers to accept temporary commissions. It is probable that not many temporary or reserve officers would continue on duty as temporaries if they are certain to be dropped July 1, 1920. They will rightly take the view that if they must finally go back to civil life the sooner they get there and stay there the better. On the other hand, if the 1921 appropriation bill should carry an increase in the authorized enlisted strength and provide also for the increase of officer personnel to meet it, those that stay in or come in will then be in a position to accept permanent commissions with great advantage to themselves.

In view of the assumed uncertainty of our future naval strength, legislation similar to that of the Senate bill is probably all we can get even though it does fail to meet the requirements. It will leave us in an uncertain condition at a time when it is most necessary to build for the future. Perhaps the worst thing about not getting adequate legislation now is that we will lose our opportunity to get qualified officers, for when the bill does pass—having become weary of the uncertainty,—practically all of the temporary and reserve officers will have left us and will not return even though the legislation takes a form that would permit them to do so.

Thus far I have dealt almost entirely with the number of officers the navy needs, the number we will have if certain proposed legislation is enacted, and the resulting promotion. Those are points that we are interested in because of their effect on us per-

know the navy needs, and we cannot know navy needs without knowing naval warfare from top to bottom.

In keeping with what I have just said another point has presented itself. Since the Selection Board has been in operation the Bureau has heard many complaints about our "reports of fitness." The Selection Board has a very hard task to perform because our reports of fitness seem to be "too good." Officers who have served on the board complain that the marks are too high and that while the average mark *should* be about 3.4 it is actually about 3.7. There may be much truth in their contention, and closer marking would be a tremendous help, but as a matter of fact our present fitness reports as drawn up can not give good information as to what officers are most suitable for promotion.

The man who should be selected for promotion is the man who will best perform the duties of the *next higher grade,* and not necessarily the man who can best perform duties in the lower grades. Therefore, what a selection board wants is information that will show who will do that best work in the higher grade. Our present reports cover only the duties an officer *has* performed, and because we have the most efficient officers in the world and because they do the work assigned them thoroughly, the marks on present duty must invariably run very high. Marks in one's present grade are necessary and are a great help since it is certain that a failure in a lower grade will not be a great success in a higher. But a successful man in a lower grade may not necessarily be a success in an upper grade. The time is coming, and coming soon if selection is to be successful, when officers must show their ability to handle the duties of a higher grade *before* they are selected. It is not a difficult thing to determine, and if we all go in for it, it can be made successful.

Our present reports of fitness amply cover an officer's ability on his immediate duty. We must now find a way for an officer to demonstrate his fitness for higher duties. This can be done by ascertaining his ability as strategist and tactician, his ability to estimate any situation that confronts him and to reach sound decisions as to what to do, his ability to issue short and clear orders to carry out his decisions, etc. The *first step* to train officers in these things is to *require* us to take either the regular or the correspondence course of the Naval War College. Every officer when he reaches the rank of lieutenant commander must begin

that work, and every officer of that rank or above it should immediately start one or the other course, if he has not already taken it. *And he should complete the course.*

Every officer who makes up his mind to do so can complete an installment of the War College correspondence course each quarter. Those who take the correspondence course should complete it in three and a half years or less; those who take the regular course will complete it in one year. In each case officers should be given marks *by the War College* on each problem or installment completed, and these marks should be tabulated to show an officer's ability along the various lines required of a high commander and these marks made a part of the officer's official record in the Bureau of Navigation. Officers who take the correspondence course should later and as soon as practicable also take the regular War College course. If we require from each officer only the above War College work not only will we have done much to improve our personnel, but more than that we will have at least something on which to form an estimate of an officer's fitness for higher command.

Our work of preparing ourselves should, however, go much farther than just the War College course. It must continue all the time if each officer is to progress and keep up with the developments of naval warfare. Furthermore, the navy can develop itself in all its functions only by its officers knowing all phases of its work and it will develop properly only to the extent that all its officers go in for the navy's and their own development and study the problems, large and small, and the needs of a navy that is constantly improving. Therefore, when a War College course has been completed further problems should be sent out to officers to solve, one for the each half-year covered by a fitness report and embracing new phases of naval warfare, and officers should be assigned marks on their ability to handle the various features of that problem. By having a record of those marks in the Bureau of Navigation we will have at hand an excellent means of determining an officer's naval value, but the greatest value of the system will lie in the fact that our officers will be made much better officers and will thereby make the navy as a whole very much better.

The only difficulties in such a plan lie, *first* in the way it is entered into by the service, and *second,* in supplying the large per-

sonnel to the War College to carry on its work. As to the first difficulty if we have our hearts in our work, and the country's as well as the navy's welfare in our hearts, there will be no opposition to this plan, but on the contrary an actual demand for it. The second difficulty will be serious, but it can and it must be overcome.

During the war with Germany the officers of the U. S. Navy did their work in a way that makes them deserving of all the reward and all the credit that has been or can be given them. Only those who were in close touch with the various forces ashore or afloat know of the tremendous work and the efficiency shown by the officers of the regular navy. That work upheld the best traditions of the service, and had our officers done no more than the duty they did in war operations they would be deserving of the very highest praise. But although that work was splendid and trying, officers doing it still found time to make, train, and develop, thousands of more of their own kind. Their achievements in this respect were even more remarkable than their operating achievements. Both were due to the remarkable spirit and tireless energy of officers who brook no defeat.

The spirit shown throughout the war by our officer personnel left nothing to be desired, and it was nowhere better shown than in their dealings with the Detail Office of the Bureau of Navigation. Personal desires and wishes were expressed, of course, but there was no other effort made by any officer to get an assignment to duty. When practicable the expressed desire of an officer was granted, but whether his request was granted or not the officer invariably took whatever duty he was assigned to without once questioning or objecting to the decision.

No one seemed to have any desire other than to do what he could to win the war in the place the Bureau thought he was needed, and no matter where he was sent he put personal affairs in the background and never complained, but went ahead to do his part fully and completely. It was this spirit that made the navy what it was in the war, and it is the same spirit that will guide us now and make us make our navy what it ought to be in the future, the best and most efficient navy in the world.

On the whole, better times seem to be coming to us in that we are probably to have a more nearly sufficient personnel. Promotion should remain good, and there will probably be enough officers to enable us to accomplish much more than we have been able to

in the past. In return for these improvements it behooves us as officers to leave no stone unturned to better ourselves and our service. We must never again lose sight of the importance of sufficient personnel, but no matter whether we get sufficient personnel or not we must make ourselves and keep ourselves efficient in *every* part of our work.

Our work in the past has been hard, and never harder than during the thirty months just completed. Those months have made our sufficiency and insufficiency, and our efficiency and inefficiency stand out. We must not again go back to what we were before the war, or be satisfied to be anything but to be the leader of the navies of the world. The quality and efficiency of our navy of the future will be the quality and efficiency of our officer personnel. The United States Navy will be what you and I make it. It will be just as much but no more than we make of it *and of ourselves*.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE VOLUNTEER NAVY IN THE CIVIL WAR

On account of the emergency created by the great rebellion of 1861, a large increase in the number of officers of the navy became absolutely necessary. The number of vessels in the navy, of all kinds, on March 4, 1861, was 76; the number purchased during that year was 136, and the number constructed 52, making the total number of vessels in the navy in December, 1861, 264, or 188 more than March 4, 1861; and the number of enlisted men was increased during the same period from 7600 to 22,000. This great increase of vessels and men required more officers than the navy at that period, weakened by the withdrawal of many officers of all grades to engage in the rebellion, could furnish; hence the Secretary of the Navy, early in 1861, determined to appoint acting officers, or, as they were called, to distinguish them from regulars, volunteer officers. There were several sources from which this required supply of officers could be obtained: 1st, the officers who had, during time of peace, resigned; 2d, acting midshipmen who had resigned, before graduation from the naval school; 3d, those persons who had formerly served in the navy as petty officers and enlisted men; 4th, pilots and men employed in the western rivers; and, 5th, and by far the most prolific, the commercial marine. Those appointed from the commercial marine, while being good seamen, were not proficient in gunnery, and, besides, they lacked the advantages of naval training; therefore, they were generally ordered first for ordnance instruction and the requisite and proper training. Notwithstanding the stringent regulations for discipline peculiar to the navy, the military bearing and address required, and the disadvantages before referred to, the good services and record of these officers are attested, not only by the large number of promotions after examination, but by many promotions for gallantry in battle and for faith-

ful service, and by the fact that after the close of the rebellion 4500 were honorably discharged with the thanks of the department, and many were admitted, after examination, to the regular navy and to the marine corps. During the year 1861 there were appointed 23 acting lieutenants, 29 acting volunteer lieutenants, 562 acting masters, about 300 masters' mates, 88 acting assistant surgeons, 93 acting assistant paymasters, 240 engineers, and 340 officers of all grades in the Mississippi squadron (those in the Mississippi squadron were mostly appointed early in the year 1862), a total of about 1700. The acting lieutenants were officers who had formerly served in the navy; the acting volunteer lieutenants had not previously served in the navy—at least, not as commissioned officers. Masters' mates having been in many cases appointed by commanding officers of navy yards, squadrons and vessels, under general authority from the Secretary of the Navy, considerable trouble is experienced in arriving at the precise number in that grade, but 300 is doubtless a fair approximation.

Between March 4, 1861, and July 24 of that year, all acting appointments were made as a "military necessity," without direct authorization of law, but the act of July 24 provided that the "temporary appointments made, or which may be made, by the Secretary of the Navy of acting lieutenants, acting paymasters, acting assistant surgeons, acting masters and masters' mates are ratified and confirmed as temporary acting appointments until the return of the vessels in which they are respectively employed, or until the suppression of the present insurrection, as may be deemed necessary." In July, 1862, the Secretary of the Navy began appointing acting ensigns, and the act of March 3, 1863, legalized the appointments.

As the rank of all the acting officers (except masters' mates) corresponded with that of regular officers of like grade, their pay was made the same. By the act of May 17, 1864, the appointments of acting commanders and acting lieut. commanders were authorized, and by the act of March 3, 1865, the appointments of acting passed assistant surgeons; and the same act directed that masters' mates (or acting masters' mates) should be styled mates, and also provided that mates could be rated from seamen and ordinary seamen, such rating not to discharge them from their enlistment. The rating of enlisted men as mates had, however, been previ-

ously authorized by the Secretary of the Navy under the department circular of October 7, 1863.

It is entirely impracticable to give anything like a fair and correct history of the individual services of these officers of the volunteer navy; indeed, such history would necessarily be incomplete, and there would, doubtless, be "invidious distinctions." Many acts of personal prowess were not specially reported, and, in the hurry and confusion incident to the times, the gallantry and meritorious services of not a few were unintentionally overlooked, or not properly recognized and rewarded. In the second year of the war (July 16, 1862), it was enacted that any person who shall have received, or shall hereafter receive, a temporary appointment as acting volunteer lieutenant, or acting master in the navy from civil life, may be confirmed in said appointment in the navy, and placed in line of promotion from the date of said confirmation if, upon the recommendation of the President, he receives the thanks of Congress for highly meritorious conduct in conflict with the enemy. Although no promotions were specially made under this act, there were many made for gallant and meritorious conduct, and at the close of the war a board was organized (act of July 25, 1866) for the examination of candidates from the volunteer for admission to the regular naval service. Any line officer who had served two or more years in the volunteer service was allowed to appear before the board. The number of candidates summoned to appear before the board was 426, the number appearing was 305, and the number found physically, mentally and professionally qualified was 64.

It should not be presumed that those admitted into the regular service were the only ones qualified therefor. A large majority entered the volunteer navy for the single and heroic purpose of giving their services, and, if need be, their lives, for the preservation of the Union. That object attained, and the authority of the government re-established on land and sea, resignations in large numbers immediately followed, the volunteer deeming his work and duty done, and the object for which he entered accomplished.

On May 1, 1865, the rebellion being then practically ended, the work of reducing the volunteer navy was commenced. The Secretary of the Navy ordered that, in mustering out volunteer officers, all in the service on that date should be allowed one month's leave of absence for each year of service. On the 1st of January, 1865.

there were 5278 volunteer officers of all grades in the navy, while on the 1st of January, 1869, there were but 170, and on the 1st of January of the year following only 111.

It was not, however, until July 15, 1870, that all acts or parts of acts authorizing the appointment of temporary acting officers of the navy, except as to assistant surgeons, were repealed. The authority of the Secretary of the Navy to retain any volunteer officers after the close of the rebellion was given by the act of July 25, 1866, and the exercise of that authority was by the act made conditional upon its being required by the exigencies of the service.

Of the 64 officers mentioned above, the ex-volunteer line officers living at this date are Rear Admirals Ch. O'Neil and O. W. Farenholt, Captains G. R. Durand, J. K. Winn, W. H. Webb and C. A. Schetky; it is believed the latter is the oldest living officer in our service.

(The above information is from a clipping and data furnished by Admiral Farenholt.)

[COPYRIGHTED]

SHIP *BETHEL*

By T. G. Frothingham

To show the enterprising spirit of the American Colonial Merchant Marine, the cradle of the U. S. Navy, the following is of interest:

The Boston *Evening Post* "printed August 29, 1748, by T. Fleet, at the Heart and Crown in Cornhill," contains the following letter, which is also given in full in the Memoirs of Josiah Quincy, Jr. ("of 1775") and of His Ancestors, by Eliza Susan Quincy (Boston, 1870).[1]

[1] MSS. in possession of Mass. Historical Society.

St. Johns, Newfoundland,
August 1st, 1748.

To Messrs. Quincy and Jackson.

Gentlemen:

My last was from Leghorn 9th of April, to which refer. We sailed thence 10th do. 16th took the *St. Joseph* a Polucca Punk from Salonicka for Marseilles, Jo Chaupe deBarr, Master, loaded with tobacco, which carried with us to Cagliere, and after performing Quarantine sold her for 5000 Dollars. We had her condemned in Port Mahon (where left the money with Messrs. Ferrand Miller & Co., to be remitted Slingsby Bethel Esq'r,—all which I suppose Mr. Bethell has informed you of e'er now. The 10th June we left Gibraltar, the 19th in Latitude 36° N. off Isle St. Mary's met with and took the *Jesus Maria and Joseph*, a Spanish Register Ship, Don Antonio De Borges commander, from the Havana for Cadiz, with 110 men, and 26 guns. The cargo we are at a loss to know the value of, as the papers were all hove over board, but by best account when she left Havana was valued at 300.000 Dollars. have found on board in specie 171.000 Doll's. Her other cargo is Cochineal, Hides, Snuff etc. We having such a vast number of prisoners to secure and both ships to man and only 37 men and boys on board were obliged to put in to Fayal, where we have been most barbarously treated, as imprisoning myself and people, attempting to force our prize from us etc.—in short must leave particulars till I have the pleasure of seeing you, which God grant may not be long. We left Fayall 2d July, and being short manned as you may judge, and credibly informed of divers Spanish cruizers on our coast, could not think it prudent

to risk two such valuable ships on the coast without Insurance, as such Insurance of the *Bethel* is broke by this deviation, and determined to proceed to the first port, which was this, where we arrived 28th July. Have applied to the Judge of Admiralty to condemn the ship, for judging it best for divers reasons to have her condemned as soon as possible. It seems there is some difficulty about condemning said ship in the Plantation as she is a Register ship, which I doubt not will soon get over—cannot yet positively say when. shall advise you per Capt. Huske, how I shall proceed. If it is not possible to condemn the ship and she must go to England it will be hardly worth while to bring her to Boston. Should she be condemned, the *Bethel* and she in company sufficiently manned I apprehend there will be but little risk between here and Boston, for which reason have lightened the *Bethel*, who is exceeding deep with salt etc. per Capt. Collins, by whom these comes, and who is to have 402£ old Tenor for freight, I advise with Mr. Bethuen about proceedings.

Your family I hope are well and must desire your care and assistance by all necessaries to mine which this long absence almost makes me despair of seeing

I am Gentlemen with due respect

your most obed't humble serv't

ISAAC FREEMAN.

P. S. Particulars of taking the prize follow. About 6 P. M. we made a sail, to which gave chase, as we were standing partly towards each other soon found her to be a large ship, and she took in her small sails hauled up courses as getting in posture to engage us, but we not regarding that she soon made all the sail she could pack in order to run. We having the heels of her overhauled her apace and the night though very dark was not able to conceal her from our sight. finding we had the heels of her as before observed, assured us if she should prove too stout we could but make a retreat. At 12 at night was alongside, when after a serenade of French horns and trumpets etc. demanded from whence she came and whither bound. When after a few equivocations allowable in such cases, as pretending to be from Surinam for Holland etc. She announced she was from Havana for Cadiz, at which we gave them a hearty cheer. and ordered her boat and Captain on board immediately. He begged we would tarry till morning as his boat was large and leaky, but we threatening him with a broad side which he much feared he complyed.

By daylight we had the last of the prisoners secured, who were ready to hang themselves on sight of our six wooden guns, and scarce men enough to hoist top sails. You may easily imagine we had enough on our hands till they were landed at Fayal. I believe its the first instance of such a prize being taken by so small a force without firing a single on either side, but however I assure you I esteem it much better than fighting.

Since writing the above have seen the Judge who says he sees no difficulty in condemning the prize here, nor expects to meet any, but as there are many papers to translate it takes some time. I shall write Mr. Bethel next week as I have done from Fayal. Notwithstanding the valuation above have some reason to think she may be worth twice the money. but not having broke bulk can't say.

The following is the comment of the *Post* on the capture:

> This is, perhaps, the only Instance since the War began, of so stout a Ship's being taken by so small a Force, without firing a Gun; and the Spanish Don may truly be said to have been jockey'd out of a Prize worth the best part of an hundred thousand Pounds Sterling, by the Courage and Art of an honest New-England Man.
>
> The Art of fighting, each Commander's Care,
> Lies not in Strength, but Stratagems of War.

Additional details of this surprising adventure are given in the mss. Quincy Memoirs:

> In 1748 he [Josiah Quincy] went to Europe a third time, first to Ireland, and from thence to England and France. While he was in France a remarkable event happened. His brother Edmund Quincy, Edward Jackson, his brother-in-law, and himself, were mutually concerned in a ship named "the *Bethel,*" which they sent this year on a voyage to Europe. At that period there was a war with Spain, and danger was apprehended from the Spaniards, who were in the habit of attacking English vessels, and treating their crews with the greatest barbarity. This merchant-ship therefore, was fitted out with fourteen guns, which it was thought might overawe their enemies, and keep them at a distance, and one of the owners also obtained a letter of marque for the commander, Captain Freeman.
>
> Accidentally falling in with a Spanish ship in the night time, the Captain thought it prudent, to make as formidable an appearance as possible, in self-defence. He therefore mustered all his men (about thirty eight) upon deck, increased their apparent number by putting all the hats and cloaks, which could be found on sticks, and then hoisted lanterns in all parts of his ship.
>
> To the astonishment of all on board, the Spaniards deceived by these appearances imagined themselves on the point of being attacked by an armed vessel of great force, and surrendered without the slightest resistance, not even firing a single gun.
>
> The ship proved to be the *Jesus* Register Ship, bound from Havanna to Cadiz, loaded with gold and silver to a great amount, carrying twenty-four guns, and one hundred and ten men. Surprised at the success of their own manoeuvres, they secured this valuable prize, although the rage and vexation of the Spaniards knew no bounds, when they found they had surrendered, to such an inferior force. This discovery however came too late, and they were forced to pay the penalty of their cowardice, by the loss of their ship, and her precious cargo. It was carried into Fayal, and from thence to Boston, where it was condemned as a lawful prize, according to the laws established among nations respecting property in such circumstances. In this instance, as the treasure taken, belonged to the king of Spain, the owners had the good fortune to realize a handsome property, without injuring any private individual.

article; and when some weeks later we learned that no less a person than the Secretary of the Navy had taken cognizance thereof sufficiently to demand verification of its statements from the governor, we shook in our white canvas shoes. But the Secretary did more than verify—he disseminated information. To our infinite amazement we began to receive letters from members of Congress, from the Land Office, from the Chambers of Commerce of San Francisco, Honolulu and Manila, and from the governor of Samoa. It was a case of make good or back down, and we attacked the problem of Guam's commercial and financial situation with an energy born of fright. Immediately our head ran hard against the stone wall of *there are no ships*. We continued to write and struggle, with the very hearty backing of the governor; and, after scoring several flat failures, finally summed up the problem as follows: "Without ships, Guam cannot market her surplus products, and will not raise anything to balance her imports. Until Guam raises a surplus for shipment, no ships can be induced to stop here. To make the planters work hard enough to attract regular shipping, some one must furnish *a* ship at a temporary loss." Apparently the Navy Department reached the same conclusion, and the old *Supply Maru* began carrying copra to Manila. There are now regular schooner lines plying from Guam both eastward and westward. The island is started toward economic independence.

In 1916, a Pan-American trade congress was held in Buenos Aires. The United States High Commission was prepared to discuss banking and exchange problems, monetary standards and credit systems. With one accord the South American delegates cried for ships! ships! More ships! Without them any system is useless; with them credit can quickly arrange itself. At that time, Brazilian planters were begging small schooners to take away their coffee at $22 a ton and over; and the price of coal on the Rio waterfront included a freight rate of 110 shillings a ton.

In 1917, the submarine stated the question all over again in stentorian terms, ending with a thunderous exclamation point, and the world suddenly cried out in agony, "Send us ships or we die!" We stopped searching for the best, the quickest and the easiest way. We had no more time for study. We had to build ships, and we built them, and we now have them in large numbers. So to-day we have, on one hand, the same old problems of trade development for which ships are the only answer; on the other,

a large number of ships engaged in an abnormal trade which, if continued after the emergency has passed, will place us in a position antagonistic to our present Allies and our own shipowners.

The ships now at our disposal are grouped into five classes:

(1) American-owned ships taken over for the war.

(2) Foreign ships chartered.

(3) Foreign ships requisitioned.

(4) Captured enemy ships.

(5) Ships built since the outbreak of the war by the Emergency Fleet Corporation.

Classes 1, 2 and 3 are ours but temporarily and must go back to their owners in a very short time. There remain indefinitely on the government's hands classes 4 and 5, numerically in excess of the first three classes. Each ship of classes 4 and 5 represents a large investment of money obtained by the sale of Liberty Bonds, for which the taxpayer will be furnishing interest for some years to come. If we sell or lease the ships to privately owned lines we must do so at a price far below their actual value; for besides the depreciating effect of the sudden offering for charter or sale such a large tonnage, our laws do not permit American ships to compete with foreign ones for oversea business unless they can in some way materially reduce their initial cost. In other countries initial and maintenance costs are both government-aided by subsidy. We have definitely declared against any form of subsidy other than for carrying the mails. Consequently, a private company buying our ships must beat us down to a figure which will enable them to operate. We will not get the full price to redeem the spent Liberty Bonds, and would have nothing but our annual interest charges to remind us that we were once shipowners. To meet this interest we must tax a man enough to pay him back with his own money. Similarly, with the return of normal peace conditions and normal competition, any rental which we could exact for private charter would barely return us our interest and leave the bulk of the people saddled with the responsibility of producing the money necessary to repay their maturing bond investment. With all our distrust of the new and untried in governmental procedure, we are faced with the necessity of either costing ourselves and the country much money or of running those ships to profit ourselves. Until the last $50 bond which entered into the refitting and construction of those ships is repaid, they cannot be written into the national plant

account. They represent an unfulfilled debt, and we have no right to dispose of them at a loss unless we first declare ourselves nationally bankrupt before our own people and persuade them to accept a settlement at something under cent per cent.

The problem of Guam is the problem of the Southern Philippines. Many times multiplied, it is the problem of South America, of the China Coast, of the entire world below the Tropic of Cancer. When the government put a ship on the Guam run, the trade developed and an entire nation, small though it be, was set upon the path of independence. If we do not run our ships, we will as a nation lose both money and trade. If we do not run our ships, we must look forward to undeveloped islands, unexploited markets, alienated friends. Both sides of the quandary are forcing us forward along the resultant line. We must run our ships ourselves.

Immediately arises the first objection in the form of the rights of private-owned steamship companies operating under American register. These companies were plying their trade and making a living before the war. At considerable inconvenience and danger to their carefully established goodwill, they patriotically stood silent while we took their ships from them and ran them for the prosecution of the war. Now that we return them their ships, shall we take away their trade by competing with them? The Socialists might answer "Yes!" but as yet they represent but a small minority of our people. At the present time such a course would raise a storm of protest from every line of business, from the farm to the factory. Let us avoid this objection then by resolving in the beginning to leave these gentlemen alone in their fields—in the wide world there is room for them and for us, and for our Allies as well. With every cockboat in the world working, there will for a generation be a shortage of ships, and probably there will never be as many as the world could use at any one time.

A glance of Chart I will shed immediate light on the problem. American steamship companies have by no means girdled the world as yet—have not even attempted to cover the available first-class trade, and have hardly touched the tramp trade at all. Surely, from these few lanes we may sheer wide and still employ all our tonnage. We may even leave the transpacific field from which the Pacific Mail retired after the passage of the Seamen's Act in the expectation that the run will be reestablished after the

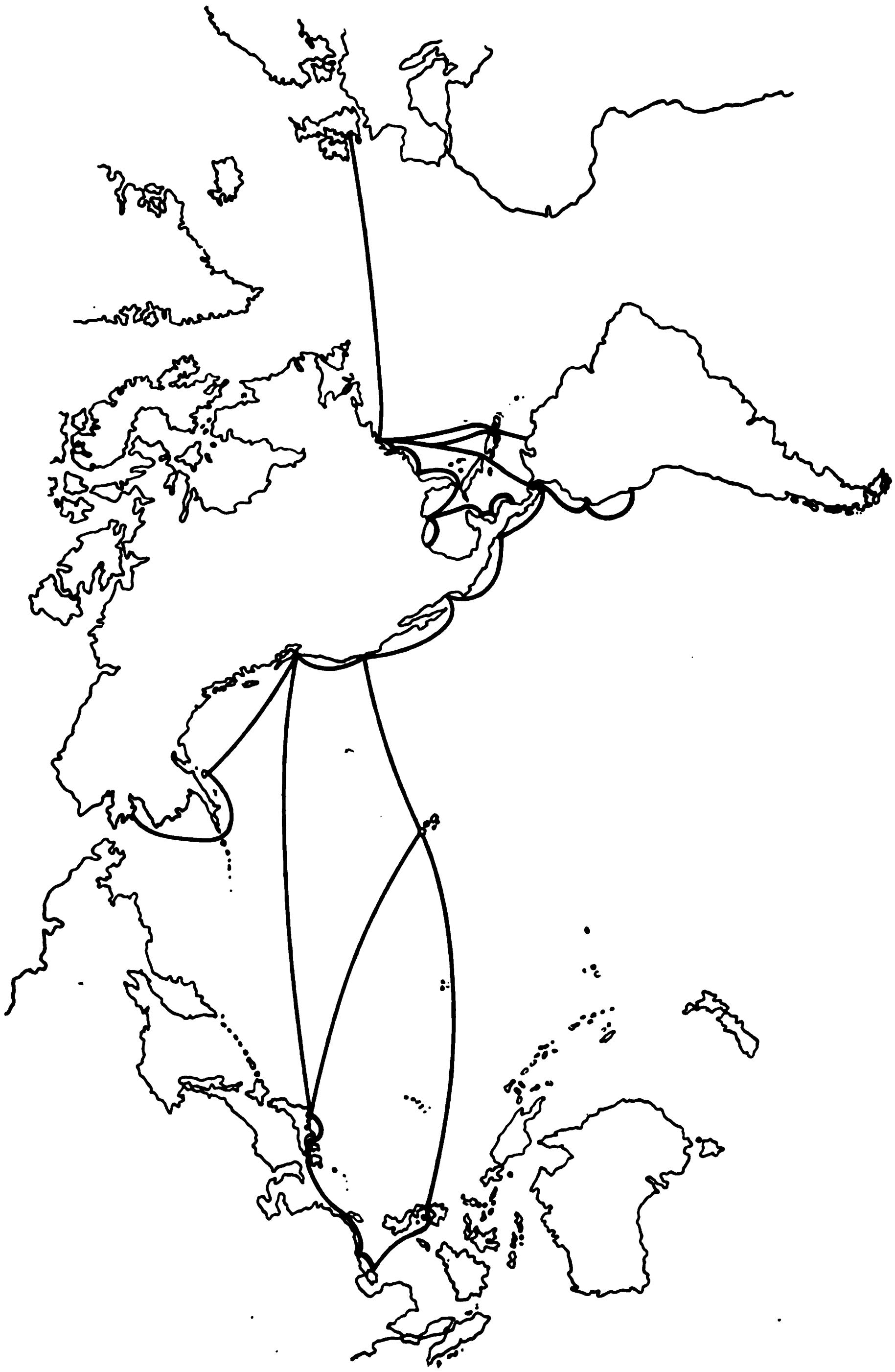


Chart I.—Principal American Steamer Lanes In Use Before the War.

reconstruction. If not soon restored, effort should be made to induce private companies to again enter on the old Oriental run; for there is a case of market and goodwill already existing, blown open by Perry's guns in 1854. As long as there remains in the world possible, logical trade for American planters, manufacturers and merchants, our historic duty is to open the trade, to create goodwill and demand, and then to leave it to the citizens of the United States to exploit the new market we have given them. The market and the return goods will not be forthcoming until the ships arrive ready for business. The private-owned ships will not gamble on a market until they are assured of orders and a return cargo. And so, since the days of King Arthur, governments have sent out expeditions to the uttermost parts of the earth to make commercial treaties, to exhibit samples, and to bring them back, to create another market for the people at home to exploit.

II

In Chart I there appears but one line south of Panama, and that represents a desultory, semi-occasional run of the Pacific Mail to Callao, the ships employed being the gallant survivors of an ancient fleet built in the old soft-iron days. It is true that there are American tramps encircling South America in the name of W. R. Grace & Co., but this company, huge and far-flung as are its interests, has not even scratched the market, which was once fairly well taken up by the Germans. American shipowners did not trust the South American run. They alleged, first, that credit was unsatisfactory, second, that repeat orders were few; third, that a return cargo was uncertain. The United States, in 1915, was avoiding South America from experiences of the past, and had not yet opened its eyes to changing conditions.

To illustrate: Some 20 years ago, an American firm was invited to bid on a large amount of machinery and instruments of precision for the Argentine. The total order was in the neighborhood of ten millions of dollars, and the company figured long and carefully. To their great resentment, the order went to a German firm at a figure slightly above their bid, and thereafter no attempt was made to expand their territory into South America. And yet the reason was based on pure misunderstanding of the desired market. The drawings accompanying the American bid showed scales of ounces and pounds, yards, feet and inches. In a country

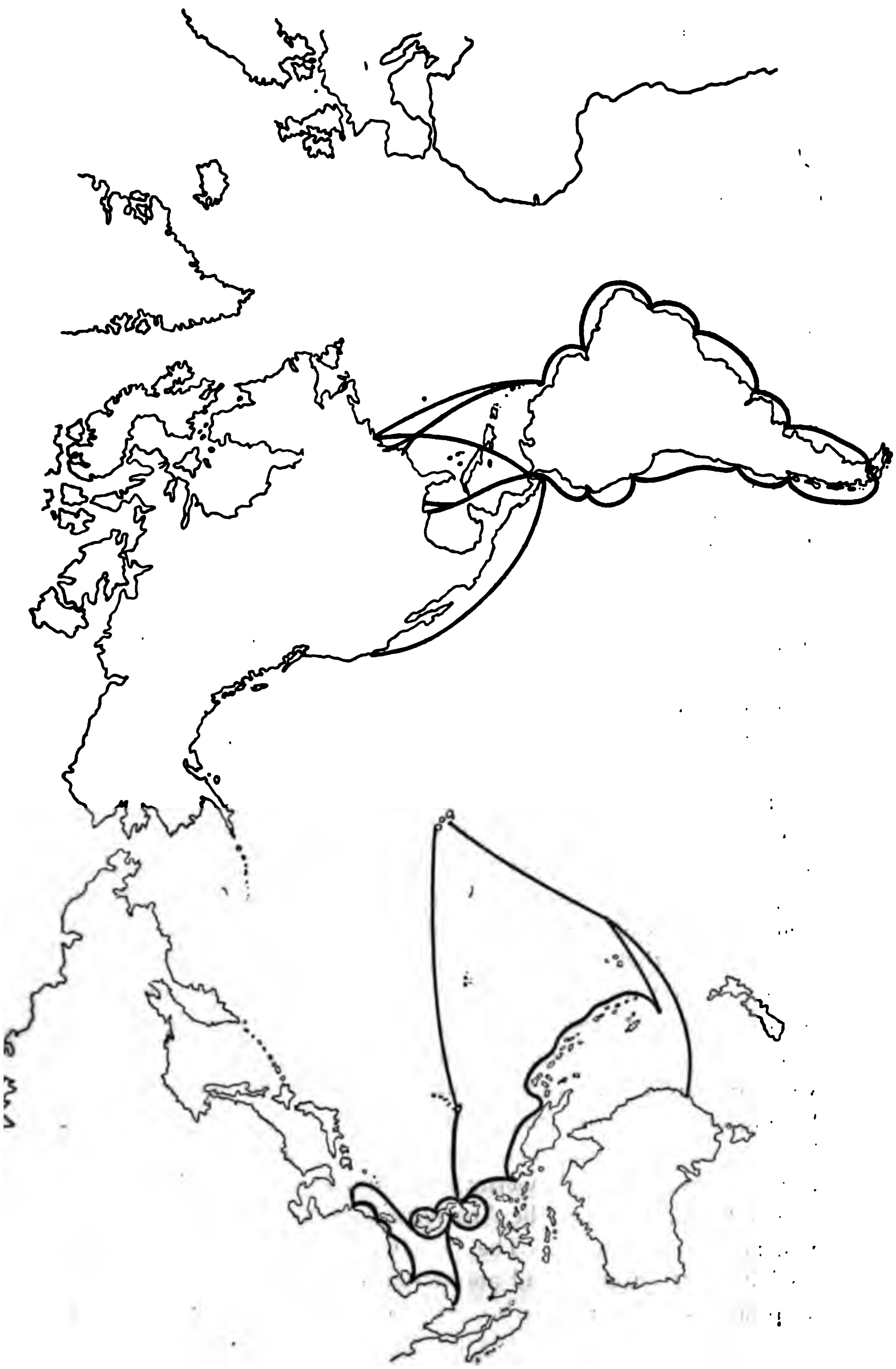


CHART II.—New Lanes.

which uses the metric system, the natural thing to do was to award to the specification bidder, *to whom they already owed money*, even at a slightly higher price.

The manager of a large department store in Santiago, Chile, was showing a party of American naval officers over his establishment. He had been educated at Columbia, and had decided pro-Gringo leanings; yet he led us past counter after counter laden with goods bearing the German mark. He answered our question by bringing out two aluminum saucepans of ordinary size. One was a heavy, honestly built affair, seamless and well finished. This was American made. The other, while of the same size, weighed barely half as much, was soldered together, and had a wooden handle. It bore the familiar "Made in Germany" stamp.

"Now," he said, "which do you buy, if you are a Chilean?"

In view of the obviously better construction of the American pan, the question seemed foolish, for the prices were identically the same; but the answer depended again on knowledge of the market. The average Chilean cooks on a Spanish concrete stove, hardly more than an open fireplace. Flames play freely up and around the bottom of the pan. The American metal handle grows intolerably hot, so the Chilean looks regretfully at its solid construction and buys the usable though flimsy German product.

Misunderstandings of the sort quoted above can be and are rapidly being removed by modern merchandising methods. There remains only the age-old distrust of the Latin for the man who speaks English. This dislike of the Gringo, one may be sure, was not overlooked by the Germans, who did all they could to keep it awake; and as long as a German was *persona grata* in South America, it was a very real obstacle, for the South American would rather make 5 per cent trading with a friend than 15 trading with a man he does not like. Conversely, however, the South American remembers his enemies, and the fact that practically every country south of Mexico broke diplomatic relations with the late enemy is guarantee that his name will remain a hissing and a byword long after we have forgiven him and let him buy and sell in our market-place. The bulk of South American trade was formerly German; but unless we deliberately force Brazil, Chile, Peru and the Argentine back to German markets, it will never again be so. The fact that we did not do the thing obvious to the Latin mind and annex Chihuahua in 1915 stands as proof to our southern brethren that we have no ambition to

dominate the Western Hemisphere to their detriment. There is also reason to believe that the thoughtful work begun a few years ago will end in a satisfactory international credit system. Other points of contact being smoothed away, the merchants of South America stand ready to welcome us with open arms. To reach those arms, *there must be ships!* Private companies have not got the ships, nor will they have until the trade is solidly on a paying basis. We have the ships, and *it is our bounden duty to the country to make possible its entrance into that market!* The coffee, sugar and rubber of Brazil, the beef, hides and grain of Argentine, the nitrates, copper and minerals of Chile and the precious metals of Peru await our ships and their people await the goods we may make for their needs.

III

We have for almost a generation been warned in red-hot, impassioned language to guard against the Yellow Peril. From 1905 up to the outbreak of the Great War, not a year passed without apparent and sometimes real danger of war with Japan, and the possibility of an awakened China and a solid Asiatic alliance against us was a bugbear continually in sight. We know now that the majority of this talk and the majority of the friction with Japan may be contemptuously laid at the door of the Bosche, who assiduously sowed the seeds of misunderstanding. Such of the trouble as was caused by us or by the Japanese was the direct outgrowth of that misunderstanding, and also of the other German propaganda and Germanophile fetish which led Japan dangerously near to Teutonic line of thought of domination and supremacy. Both parties now know that they have been duped by a third, and that in place of being natural enemies, Japan and the United States are logically friends and business partners. As for China, she is to-day and for some time has been solidly, blindly and almost fatuously our friend. Had China dared, there is every indication that at several periods of 19th century history, she would gladly have closed her ports to the world at large and made the United States and possibly Great Britain her only creditors and customers. The possibility of shutting out even Great Britain is in view of the opium trade from India, which every Chinese Government has hated and been unable to stop. Our position as popular favorite has been ascribed variously to the missionaries and to our return of the Boxer indemnity.

Neither reason is a true one—when the missionaries are not inflaming the resentment of the inland and medieval Tao Tsai or the fanatical secret brotherhoods of Mongolia, they are furnishing exactly the same metaphysical interest for the philosophical and hairsplitting Chinaman as the missionaries of other nations. Even where longest established and most firmly settled, the missionaries in China have made no preponderating impression on the vast Chinese people. Even in Macao, Jesuit since the 15th century, Chinese Mahommedans predominate, with Taoists a close second. And in North China, Marco Polo found a large percentage of Nestorian Christians, whose descendants in doctrine, like the adherents of Thibetan Lamaism, consider themselves Christians already and considerably nearer to the root of the matter than the missionaries themselves. As for the Boxer indemnity, not one Chinaman in a hundred thousand ever heard of it. No, our popularity in China has been built solely on our trade with China. Alone among the nations, we never "lost our face" in the days of clipper-ships. This is not hard to understand when we consider the men who manned the old American stick-and-string merchant marine—hard-featured, teak-faced Down-easters, keen business men, worthy opponents in "sharp practice," but absolutely men of their word when once definitely pinned to a bargain. No one more calculated to delight the heart of a Chinaman can be imagined. Moreover, in later days, when our flag was seen in the Orient only on a few large liners touching the greater ports, our fair fame was kept bright by the commercial missionaries of the Standard Oil Company, whose tiny lamps and five-gallon oil-tins have become a necessary feature of the economy of the most remote river village and so powerful a factor for prosperity, contentment and education that the Chinese Government is as grateful as any government is capable of becoming. The oil business of China is ours, and is being taken care of by private enterprise. Clearly, we have no shadow of reason for entering that particular field; but is oil the only American product which China would use if she could and which America would ship if guaranteed a market educated and waiting? We may even avoid competition with Japan and leave her the textiles trade which she has captured since the war with Russia. The most superficial inquiry should unearth some unfilled need, not of the China coast, merely, but of every one of her

hundred millions of people. To begin the fulfilment of that need is legitimate government business, and thereafter the American merchant and manufacturer will have another dependable source of revenue and China another reason for her friendship with us. The Yellow Peril will be pushed just that much farther back into the limbo of exploded bugaboos.

Moreover, since the German-made mumbo-jumbo of regional "hegemony" has been laid to rest without tears, there is no more reason for commercial antipathy between the United States and Japan than there is for a war between John Wanamaker and Andrew Carnegie. Four hundred million Chinamen eat and wear and play with more than both of these countries can ever sell them. Besides, we are fairly good customers for each other and can be better ones if we like.

IV

The ever-reliable and dependable *World Almanac* not being at hand, I am unable to state the population of the Southern Philippines. However, there are several hundreds of thousands and possibly several millions of people there in a state of civilization which grades from something better than the absolute primitive to something considerably less. The Moro, after substituting Islam for Rome, may be taken as a fairly good picture of one of our Crusading Ancestors, with his love for arms, high standards of personal honor and easily touched pride. He represents the upper level of the population, the lower approximating the Hottentot who can carry on a free and untrammeled conversation with a dog-faced baboon. We are attempting to civilize them with schools and churches. We may succeed in pacifying them entirely by those methods, but unless we return to the Jesuit tyranny of three hundred years ago, we will never make them producing members of the community by either religion or education. We must show them something desirable which they can gain only by working better and harder than is necessary to live as did their grandfathers, we must create a need. Once felt, that need will do more than any teaching to induce husbandry, trade and thrift. The old, disreputable Blackbirders realized this, and steered clear when possible of ports where missionaries were to be found. They were implanting the needs easiest to create—gin and guns—and wished no interference. At that, they did not col-

lect in their busiest days one per cent of the possible exportable goods of the islands, and they caused no greater expenditure of labor than is necessary to pick up dry cocoanuts and sea-snails. The industry of the Southern Islands and of the South Seas in general is gauged by the price of hardtack, canned salmon and blue denim. Here is a fertile field for endeavor, and again we crash against the same old obstacle—without ships, there will be no cargo, without cargo, there will be no ships. Again, it is the historic duty of the government to enter the first wedge and drive it home. Those islands will one day be developed to enormous and valuable trade by someone. It is logically ours, even if we abandon the Philippines at some future date, for Americans are the only whites in the world for whom the Moros and the lesser nations of the Southern Archipelago have ever felt the slightest respect. They have liked us and considered us capable and worthy opponents even while splitting our heads with a bolo, for unlike the Tagalog, the Southern Islander bears no malice and admires a good sportsman.

One item which the trend of matters in the civilized world will soon demand insistently from the South Seas is copra. The war has taught the world the absolute necessity of fats and oils, and while the steady decrease of the world's animal herds has in the past been a subject for uneasy headshaking, it is now becoming a question of dire and immediate urgency. Cottonseed, peanut oil, olive oil—these and more are being feverishly developed to replace the rapidly diminishing supply of edible animal fats; but greater than any of these and as yet almost untouched is cocoanut oil and its by-products. Nine-tenths of the world's copra is the result of some tattered or even naked islander's wanting a bottle of beer or a can of salmon. In a few places, copra is being systematically grown and dried, notably in Samar; but even in Samar, the output is limited by the transportation and the fact that no particular reason has been offered to spur the native to regular effort, and Samar copra is not of the best quality at that. Copra has been long a neglected asset of the world, and until the establishment of the India Produce Company of Philadelphia, practically the only markets for high grade copra were Hamburg and Marseilles. Even there, its use was largely confined to toilet articles and its food-value overlooked. And even with this limited and fickle market, medium-grade copra was worth $12 per

cwt. on the docks of Marseilles as long ago as 1911. With a very little effort on our part, the South Sea output of copra could be multiplied by five hundred, with a consequent gain to the world's supply of fats; and every pound of it could be carried in American bottoms and should be. And every cent of its purchase price at the beach could and should be spent on American goods brought in American ships. The desires of the islanders now range from beads and red calico to gilt mirrors and musical clocks. We have the ships to develop this trade, and if we do not use them, we will be omitting one of the historic duties of a navy to the nation that supports it.

Another item which we can and must cultivate in these islands is kapok, or tree cotton. In 1912, samples of Guam kapok sent to the Cotton Exchange of New Orleans for information as to its commercial possibilities elicited the reply that it would not spin or gin and was valueless. In 1913, not 18 months later, the burning of a single warehouse full of kapok in Manila caused a rise in price of *one hundred and fifty dollars per ton!* Kapok had found its use, and the world was clamoring. It constitutes practically an American monopoly at present, and while the navy alone can come near to using the world's entire output, that output measures only desultory gathering from age-old trees. Nowhere has kapok been established as a main line, nor has it been planted and cultivated, yet from the jungles of Guam alone, some twenty tons could be gathered annually. Guam is thirty miles by nine in its greatest dimensions, and its kapok trees are far enough apart to be noteworthy when found. When we bring goods of home manufacture to the islands sufficiently desirable to make the effort worth while, there is practically no limit to the kapok we can take away.

Trepang or "*beche-de-mer*" has a ready sale in China, and tons more than have ever been cured, cumber the beaches and embarrass the swimmer in every South Sea Island. Millions of feet of hardwoods wait the enterprise of the judicious forester, shiploads of dyewoods and spices are there to be taken away. Coals and metals lie waiting to be mined in these Southern Islands. The trade of the world needs them all; but the ships of the world must see them waiting on the dock before they will call. We must not only put them on the dock, but build the dock as well.

V

Some philosopher once made the discovery that the darkest place in the room is exactly under the candlestick. To look at the chart it would appear that the Caribbean and the Gulf were fairly well covered by existing steamship lines. It is then, rather a shock to the inquisitive American, when he inspects the wares of the average shop in the average West Indian town. I do not mean Havana or San Juan, for these cities have long had a definite trade link with the United States, and the ships and merchandise have appeared to handle and balance it. But we have also for many years had direct and frequent communication with Santo Domingo by way of the Clyde Line; yet in the normal Dominican shop we find Danish butter and herring, German lamps, clocks and trinkets, French canned goods, and a multiplicity of Spanish wares. Such American goods as are shown are of a grade not saleable in the United States, with the exception of bottled beers and refrigerators to keep them in. Half of this American export list will soon stop, and its absence may stop the other half. This poor showing in the shops of so near a neighbor has solid reasons, heretofore potent, but now removable by taking thought. First of all, since the days of President Grant in Washington and President Baez in Santo Domingo, the fear of annexation has led the Dominican to open hatred of "*los Yanquies.*" Since our war with Spain, this dread has at times become hysterical. As the Bishop of Santo Domingo expressed the popular feeling, "Puerto Rico—Guantanamo—Panama—Nicaragua—Haiti—St. Thomas—and now you are sitting in *our* forts!" "Better the head of a rat than the tail of a lion," cries the Dominican. But since our military occupation this feeling is changing. Admiral Knapp has been a revelation to Santo Domingo, and they begin to believe that our purpose is much more to preserve the integrity of their republic than to destroy it; that annexation by the United States is possible only as a last resort to prevent their annexation in part or in whole by a European power. They also are undergoing an era of solidity and progress which passes their wildest dreams—even outruns the plans of the late and unlamented Leli Heurreaux, who compensated his lack of justice and morality by a real patriotism and breadth of vision. The anti-Yanqui feeling is being rapidly conquered, and even at the beginning of the

occupation, many prominent Dominicans were being bitterly lampooned in the patriot press as "*ayanquizados*."

Communication is now existing here, and the only need is for a bit of careful merchandising to multiply our Dominican trade many times. The other end of the island, Haiti, is virgin territory; and legitimate ground for our endeavor. Already the majority of invested industrial capital is ours. We are to build Haiti's roads, railways and docks. Should not Haiti's payment of chocolate, dyewoods and coffee come to us in our own ships? Lasting good will has already been gained and the sound of "*Caco fini!*" brings a grin of pure delight to every black face in the agricultural part of the country.

The east coast of Central America is worked after a fashion by the United Fruit Company, the Central American Trading Company, and Hubbard-Zemurray. American goods, more or less adapted to the market, are floated down the coast, but what these gentlemen chiefly want for the return trip is a cargo of bananas. They will take other freight gladly if presented for shipment and if there is room in their holds. There has never been any violent effort made, however, to induce much production aside from fruit, and while the banana trade has no doubt been lucrative, the fact that the republics between Mexico and Panama live mainly by the desultory peon labor of the fruit plantation has made possible the never-ending series of revolutions and gunboating jobs that have been ours. Why not spend some of the time we use in preserving law and order by doing a little trade missionary work which will inevitably lead to more settled conditions? A busy man dodges a fight, and an idle one is apt to pick one.

The marines in Managua have, as usual, produced the opposite from the effect which was expected by the Latin-American world. Instead of continuing a sore spot and an offence against Nicaraguan sovereignty, they have convinced all hands that we do not wish to either conquer or annex Nicaragua. Let it also be remembered that all of these countries joined us in breaking relations with the Hohenzollern government. Most of them had no particular reason for doing so; but their action is a measure of their wild enthusiasm at what they consider a guarantee of their future. There were many of them who believed us a bully of small nations and a coward toward big ones. When we openly

tackled the biggest and fearfullest bully in the world, their excitable Creole hearts flared into similar action. With the Central Americans we have " made more character " in the past two years than in any previous fifty, and their friendship and their trade are ours to pick up if we will.

On the west coast, the same psychological advantage, long unattainable is now ours; and here we have not even a line of casual fruit steamers—we have practically nothing but the semi-occasional staggering old Pacific-Mailer ambling in between visits of the somnolent Pacific Steam Navigation Company and the spasmodic C. S. A. V. The Cosmos Line, an offshoot of the Hamburg-American, was rapidly absorbing all the cream of the west coast from Mazatlan to Chiloe, and the Cosmos Line is now out of business and out of favor everywhere but in Mexico. Is there any reason why the copper mined by the Guggenheims in Chile, the silver taken from the street of Cerro de Pasco by the Palmer Syndicate, the mahogany cut by American firms and floated down to San Marcos Bar and Salina Cruz should not be freighted away in American ships, built and manned in the United States? If it paid a German liner, 12,000 miles out of Hamburg, to work 42 ports from Valparaiso to San Francisco, stopping to " land a cabbage and a barrel of water and take on an old woman and a parrot," why should it not pay an American freighter, 4000 miles out of San Francisco or 2000 out of New Orleans?

The country is weary of the long feud between rail and waterborne traffic which has killed the once-glorious Mississippi and partially paralyzed the Panama Canal. Moreover, the railroads are weary and the ship-owners are weary. Indeed, this seems to be another rivalry of the past which has been made silly beyond all measure by national growth. There are not enough freight cars, and freight cars and ships together are none too much to handle the coast-to-coast business. Building many more railroads is slow and costly—the ships are in our hand. And unless those ships are used, *some good profitable coast-to-coast trade will not be carried on*. Their use, incidentally, should land a few heavy punches on the solar plexus of our national tyrant, the High Cost of Living. It should not be difficult for a government operated line to keep cargo rates at a figure which will permit the struggling railroads to carry their normal capacity and so reorganize their over-driven system. There will be enough left over after

the freight cars are laden to send more than one vessel through the Canal down to her Plimsoll Mark.

VI

The same factors which have contributed to the spectacular and world-wide collapse of the German Merchant Fleet and German-made good-will have placed ships in our harbors and good friends on our calling-list. Before the war, the ships of our Allies were working to capacity, and so were the ships of neutrals. The submarine has decreased those busy fleets, but they will be soon rebuilt. Meanwhile, there remains the huge vacancy left by the withdrawal of German ships and German friendliness.

Not a single article of commerce, not a single pound of freight has been so far mentioned in this article to which any of our friends ever laid the shadow of a claim. Our late enemies once gained this trade more by lying about us than by open competition, more by our own restrictions on our ships than by their superior merchandising ability.

The trade is there and the ships are here. Go to it, America!

VII

By this time, probably, every reader is wondering what will become of the fleet, if all this comes to pass, if the navy keeps and operates this great United States Commerce Navy. Operating modern men-of-war is not a stationary science in any of its branches, and a life time can be profitably spent in study and effort to perfect oneself in any one of an officer's many duties. The gunboat officer, though doing strictly naval work, often laments that " By the time I get back to the fleet, I won't be able to even put a name on half the gadgets I see! " While officers and men are plying around the world discharging tinned tomatoes and taking on teak wood and tea, what will become of their fighting education? If it be necessary for the regular establishment to man our Commerce Fleet, the ships must lie idle, for even in the unheard of contingency of Congress authorizing a regular navy of any such size, such duty would guarantee that a good seventy-five per cent of our expensively educated officers would soon become professionally behind the times and exceedingly mediocre in the performance of their legitimate naval duty. The Fighting Fleet must remain the Fighting Fleet, without any further amount of professionally stagnant duty than it now has of

necessity. Fighting ships, like fighting men, must be drilled, drilled, drilled until the human approximation of perfection is reached, or they are something less in value than the country has paid for. By the time a midshipman has been given a groundwork which will fit him for specialty work as engineer, gunnery officer, aviator, radio or torpedo man, metallurgist or ballistician, in addition to being a seaman and a navigator, he is far too valuable to be allowed to rust as third mate of a tramp freighter or even of the *Leviathan*. We must keep a keen edge on our sword, and we cannot do that if we use it as an axe or a hoe.

The answer has already been ably presented. The officers and crews of our government operated ships should not be selected haphazard from the Tarry-Johns of the world. They must be our officers and men, upon whom we may depend in time of war or threatened war; for modern war has made the freighter as great a factor as the fighter, and we must never again have to educate professionally our Transport and Train complement after hostilities have begun. The Commerce Fleet must be manned by a personnel just as entirely at the command of the Navy Department as are we of the regular establishment. They must form a permanent Naval Reserve. If at some future date it again becomes necessary for us to take over commercial ships for war purposes, we must not be delayed and the fleet must not be hindered by having to make crews and furnish officers for them. At the outbreak of hostilities, the navy should be called on for nothing more than divisional or convoy commanders, guns, and gunners. The ships should be ready to operate as they stand and steam, their commanders proceeding on their wartime errand without wasting more time than is necessary to get out their mobilization orders from the safe and tear open the envelope. Men and ships, the Commerce Fleet must be naval reserve. Their pay and maintenance must not be charged against the navy except when they are actually mobilized, but must be covered by the proceeds of their voyages. We must avoid even the appearance of expense to the tax-payer. He has not always the time to examine both sides of the ledger, but he is sure to see the annual total of the Appropriation Bill.

There need be no fixed period for enlistment in this reserve; in fact, if we fix a term of sufficient length to insure a solid training, we might have difficulty in recruiting. Men and officers

should feel free to leave at the end of short periods—say after a term of six months for enlisted men or a year for an officer. They must, if they so leave the service, hold themselves in readiness for call in time of war for some years afterward; and naturally they would, by so doing lose any benefits of continuous service and longevity which they might otherwise receive. Ratings for men should be as far as is necessary, the same as in the regular establishment, carry the same rates of pay and the same four-year increases. Rank for officers should grade from cadet (midshipman) up to and including lieutenant commander for the deck and engine-room in time of peace, up to and including the rank of lieutenant for the supercargoes, pursers and doctors. The control and center of this reserve must be situated in the Navy Department, and a regular officer with the rank of rear admiral and the title of Commander-in-Chief, Commerce Fleet, should be their commander-in-chief under the Navy Department. His duties, however, should have to do solely with the enrollment, detail and discipline of the reserve personnel.

The ships themselves must in the nature of their pioneering duty, be closely in touch with the internal and merchandising conditions of the country, and so our Commerce Fleet directorate cannot hope to be successful under the guidance of sea-going officers only. It must be closely affiliated with the navy, also with the Consular Corps, but more than either, it must be civilian, non-partison and commercial. The following make-up of the board of directors, U. S. C. N., is suggested:

Chairman, *ex-officio*, the Secretary of the Navy.
The Chief of Operations (Commerce).

Elected by the Chamber of Commerce,	New York	Two directors.
" " " " " "	Chicago	Two directors.
" " " " " "	Boston	One director each.
" " " " " "	Philadelphia ...	
" " " " " "	Baltimore	
" " " " " "	Norfolk	
" " " " " "	Savannah	
" " " " " "	New Orleans ..	
" " " " " "	Mobile	
" " " " " "	Galveston	
" " " " " "	San Francisco ..	
" " " " " "	Seattle	
" " " " " "	Honolulu.......	
" " " " " "	Manila	

Non-voting attachés to the Board of Directors, 8; as follows:

From the Staff of the Commander of Train, U. S. N	1
From the Bureau of Supplies and Accounts, U. S. N	1
From the Consular Corps, State Department	1
From the Department of Agriculture	1
From the Department of Commerce	1
Delegated by the Pan American Union	3

Two Secretaries, elected by the Board of Directors.

Our United States Commerce Navy begins to take definite and feasible shape.

VIII

For purpose of determining cost, it would appear that the only feasible method of estimate will be to, as near as possible, average the ships into classes. Roughly we can divide our Commerce Fleet into four types, *i. e.*:

1. 2000 tons, or "Lake" class.
2. 5500 tons, or "Western" class.
3. 7500 tons, of the Emergency Fleet Corporation type.
4. Captured vessels.

An approximation of cost which will not be less than actual necessities will enable us to determine the freight tariff which will enable us to operate; and in fixing this tariff we must bear in mind that the main duty of the Commerce Navy is to open new fields as soon as possible, and that at present, tariff rates are abnormally high, and so cannot be taken as a permanent basis for figuring. Actual cost, plus twenty per cent overhead, divided by probable average tonnage of cargo must be our minimum to break even. If we have then latitude to collect a bit of interest on our investment, the tax-payer wins. If we have not, he does not lose. *Either way the country wins.* Therefore, our only real problem is to find out if we can operate without a government annual appropriation to meet expenses.

First, cost of operation and overhead. It will be necessary only to estimate on the smaller type of captured liners to discover whether they can be made to pay. Under normal peace complements and a regular run, the *George Washington* should require an annual upkeep of not more than 180 per cent of the *Antigone;* but her carrying capacity will reach 300 per cent. Consequently, if the *Antigone* can work to profit, so can the larger ships. What complement will she require, what stores, what provisions, how much coal? In the following table, I realize that most naval offi-

PROPOSED COMPLEMENT, U. S. C. S. "ANTIGONE"

In command, 1 lieutenant commander.

1 lieutenant .... } Deck officers.
1 lieutenant, j. g..........
1 ensign ....

1 lieutenant commander, chief engineer.
3 machinists or chief machinists.
1 boatswain.
1 carpenter.
1 medical officer (rank of lieutenant).
1 supply officer (rank of lieutenant).
1 pay clerk (rolls and manifests).
1 pay clerk (commissary and g. s. k.).
1 C. Q. M., 1 C. B. M., 1 C. C. S., 3 C. Y., 6 C. M. M., 1 C. C. M., 1 C. P. M. (or 14 chief petty officers).
4 quartermasters (2 1st, 2 3d c.).
2 boatswain's mates, 1c.
10 coxswains.
10 yeomen (2 1c., 2 2c., 6 3c.).
12 machinists' mates (6 1c., 6 2c.).
4 electricians.
2 carpenter's mates, 1c.
1 pharmacist's mate, 1c.
6 storekeepers, 1c. and 2c.
6 water-tenders.
6 enginemen.
6 firemen, 1c.
12 firemen, 2c.
120 firemen, 3c.
1 boilermaker.
1 plumber.
1 coppersmith.
20 seamen, 30 seamen 2c., 2 officers' stewards, 4 officers' cooks, 4 ship's cooks, 10 mess attendants.

Total, 14 officers, 288 enlisted men.

Annual pay roll	$175,000.00
Annual rations	52,560.00
Annual coal (six voyages, round trips)	66,000.00
Annual stores	50,000.00
	$343,560.00
Plus 20 per cent overhead	68,712.00
Total cost, annual	$412,272.00

cers will consider me as having sent a ship to sea undermanned, and most ex-merchant officers will consider me scandalously extravagant. I know, however, that no merchant skipper would hesitate to take the *Antigone* to sea in peace times with a crew of that size, and I believe, that *with a well-trained crew accustomed to the ship and her installations,* four guns'-crews at the outbreak of war would make her fit to do the duty she has been performing since December, 1917, as a transport.

At six voyages per year (12 runs), and allowing that the ship is loaded to an average of 75 per cent capacity, the *Antigone* should haul 60,000 tons per year. Hence we have an average haulage cost of $6.87 per ton, and must use the ship on a run where she can normally expect to receive a freight tariff slightly in advance of that. One guess is enough—remember that $22.00 per ton coffee and 110-shilling coal.

Our first regular service would look something like this:

Philadelphia to Trinidad (12 knots)....	6	days.	
At Trinidad	1	"	
Trinidad to Para	5	"	
At Para	½	"	
Para to Bahia	3½	"	
Bahia to Rio de Janeiro	3	"	, run down 19½ days.
Lay-over at Rio			4 days.
Rio to Bahia	3	"	
At Bahia	1	"	
Bahia to Para	3½	"	
At Para	1	"	
Para to Trinidad	5	"	
At Trinidad	1	"	
Trinidad to Philadelphia (or Baltimore)	6	"	, run back 20½ days.

Total round trip voyage	44	days
Overhaul	16	"
	60	", or six voyages per year.

And so:

UNITED STATES COMMERCE NAVY

Beginning January 1, 1920, the following schedules will be placed in effect:

Philadelphia to Rio de Janeiro, via Trinidad, Para and Bahia.
Ships: *Pocahontas, Madawaska, Aeolus.* Sailings on the first and twentieth of each month.

Freight rates, to Trinidad				$ 6.00	per ton.
"	"	" Para		12.00	" "
"	"	" Bahia		14.00	" "
"	"	" Rio		16.00	" "
"	"	Trinidad	to Para	6.00	" "
"	"	"	" Bahia	8.00	" "
"	"	"	" Rio	10.00	" "
"	"	Para	" Bahia	2.00	" "
"	"	"	" Rio	4.00	" "
"	"	Bahia	" Rio	2.00	" "
Passenger rates to Trinidad				$ 65.00	
"	"	" Para		100.00	
"	"	" Bahia		125.00	
"	"	" Rio		150.00	

Beginning January 10, 1920:

Baltimore to Rio de Janeiro, via Trinidad, Para and Bahia.

Ships: *Antigone, Susquehanna, Huron.* Sailings on the tenth and thirtieth of each month. Freight and passenger rates as above.

That undercuts present rates by nearly 50 per cent, and in fact is below normal; and we find that we will clear, not counting any passenger traffic which may come our way, $5.13 average on 60,000 tons for each of the above six ships, or $1,846,800.00 per annum on six of our slowest and oldest ships. Interest on forty-six millions, one hundred and seventy thousands of dollars worth of Liberty Bonds.

Next, the West Coast of South America. Since the opening of the Panama Canal, and the consequent shortening of this run by some seven thousand miles, our best schedule would seem to be something like this:

From New Orleans to Valparaiso, *De Kalb, Martha Washington, Princess Matoika.* Sailings on the first and twentieth.

From Mobile to Valparaiso, *Covington, Mercury, Powhatan.* Sailings on the tenth and thirtieth.

Time consumed in voyage (12 knots):

United States to Colon	5 days.
United States to Canal	1 "
Panama to Guayaquil	3 "
At Guayaquil	1 "
Guayaquil to Callao	3 "
At Callao	1 "
Callao to Valparaiso	5 "
Layover at Valparaiso	5 "
Total length of voyage	43 days
Overhaul	17 "
	60 days, or six voyages per year.

As the above ships will perhaps average a few tons less than the Rio ships, we cannot expect to clear more than a million and a half from this run; but that accounts for the interest on $37,500,000.00 more Liberty Bonds.

Our traffic *de luxe* must necessarily be between New York, Montevideo and Buenos Aires, and on this run we will put our best, *George Washington, Agamemnon, America, Mt. Vernon, President Grant,* and *Von Steuben.* They will sail every ten days, and they will average 16 knots while under weigh. They will touch at the same ports as the Rio ships, in order to allow those who wish to pay for a luxurious passage to give up their money, but the bulk of their work and practically all of their freight will come from the far end of the run at the maximum charge of $18.00 per ton. This line figures to a clear netting of two and a quarter millions per annum, even at its enormously increased coal consumption, and takes care of over fifty-six millions more of our bond-debt.

It is not claimed that the initial voyages will produce revenue at any such rate. It is stated unequivocally, however, that as soon as the ships appear, the waiting market will begin feverishly to work to keep them on the run, and that within twelve months we will be loading very near to full capacity. Does anyone who has recently visited South America dispute it?

7500-Ton Class

The complement of these ships can be reduced easily by four officers (2 pay clerks, 1 watch officer, 1 machinist or chief machinist) and 125 men, leaving them to operate with ten officers and 163 men. Estimating their pay and rations on this basis, their coal consumption as the same and their necessary stores at 75 per cent of the passenger vessels, we get an annual upkeep and overhead of $275,400.00. In other words, to pay for themselves, they must haul an annual 55,000 tons at an average of $5.00 per ton. Fifty-five thousand tons is eleven normal, one-way runs of such a ship, and when the length of the usual $5.00 per ton water-haul is considered, eleven runs per year is a very lazy rate of working. These vessels will be the last of our freighters to leave the European lanes in normal course, and perhaps they never will leave them. If they do, there is plenty of tea in Formosa to load

them to their last ounce at considerably more than five dollars per ton, and when the tea is gone, there is camphor, there is sugar from Honolulu and all the loot of the China coast, north and south, and there are the Southern Islands. We will never lose money on these ships.

With the "Western" type of ships our coal consumption and complement upkeep drop rapidly in comparison to haulage. A payroll of $45,000.00, rations of $14,500.00, coal and stores not over $50,000.00 plus our 20 per cent overhead, make them cost us $131,400 per year apiece, or 27,000 tons at $5.00 per ton. Ask anyone in Argentine, ask the Guggenheims, ask the Palmer Syndicate, how much freight they can give us at twice that figure to any Atlantic port. Ask any of them how many times 27,000 tons per year we may count on from the jogging, port-to-port, cabbage-and-barrel-of-water trade around, through the Canal and back? The "Westerns," moreover, are ideal copra ships.

Every little "Lake" ship we own will find herself busy at home and visiting the near neighbors. Coast-to-coast and the West Indies and Central America furnish the field of endeavor for these little fellows, and at the year's end, they will be turning in a balance sheet that will cause our swagger passenger trade to shake its head and read the figures over again.

When we have finished our first twelve months as international merchants, only the worst of luck coupled with an extraordinary visitation of business stupidity—and this has never been counted an American weakness—will prevent us from realizing that we have: (1st) More friends and better ones; (2d) much more trade and more profitable trade; (3d) a dependable, sizable naval reserve which has cost us just exactly nothing. And last, but not least, we are apt to find that we have taken the First Liberty Loan off the hands of the tax-payer entirely, are paying him his interest and laying up his principal against the maturity of his bonds.

We must prepare the plans and be ready to answer the questions of Congress. Do you believe that they will hesitate to give us free rein in this matter, once it is fairly put up to them? A great deal has been said in the public press about every Congress from the first to the present assembly; but among those things has never been an accusation that they refused to permit lawful, legitimate dollars to enter the Treasury of the United States. A

great many gentlemen are gravely stating that the United States cannot profitably compete with the shipping of other nations. Perhaps not, but here, in our hand, is opportunity to make our ships profitable while avoiding competition with that shipping.

The opportunity is fleeting. In five years it will no longer exist. In two years, if America acts quickly, the firm of "America and Sons, Shipowners," will be the greatest dividend-paying concern in the world. Can America afford to bury her talent?

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AUTOMATIC GUNS

By First Lieutenant King H. Young, U. S. M. C.

Among those not intimately connected with their manufacture or use there has long been a marked inability to differentiate between the various types of automatic guns. To the lay mind any self-operated weapon firing rifle ammunition is a *machine gun* and nothing else. It is quite natural that this erroneous impression should exist, as very little descriptive matter on this subject has been written except in official orders and in technical publications designed for the use of specialists.

The British classify automatic guns according to the manner in which they are fed, operated and cooled: An automatic rifle is magazine- or clip-fed, gas operated and air-cooled, while a machine gun is belt-fed, recoil-operated and water-cooled.

The War Department has designated as "automatic guns" all automatic firearms which fire a rifle cartridge, dividing them into five classes, viz.: Self-loading rifles, automatic rifles, machine rifles, aircraft machine guns and machine guns. The first and fourth types need not here be discussed, as no self-loading rifle has so far been adopted, and as aircraft machine guns are special types designed only for mounting on aircraft.

Automatic rifles are defined as automatic guns of such light weight and of such construction that habitually they are, or may be fired from the hip or shoulder in much the same manner as the magazine rifle. Types of automatic rifles are the Browning (light), Chauchat, Hotchkiss (light), and Berthier (with light barrel).

Machine rifles are automatic guns of an intermediate class between the automatic rifle and the machine gun. The cooling system of the machine rifle usually is more effective than that of the automatic rifle, and hence the machine rifle is capable of maintaining a sustained fire of longer duration than the automatic rifle. Its cooling system is not of great enough efficiency, how-

ever, to permit of long sustained fire at rates of 150 or more shots per minute without an undue increase in dispersion. The weight of the machine rifle, or its construction, or both, usually are such that habitually it cannot be, or is not, used as a hand arm as is the automatic rifle. Types of machine rifles are the Lewis, Colt, Benet-Mercier, Berthier (with special radiator), and Hotchkiss (heavy).

Machine guns are water-cooled automatic guns which, because of the efficiency of their cooling systems and the stability of their mounts, are capable of accurate and long-sustained fire at rates of 150 or more shots per minute, and this without any increase in dispersion that would endanger friendly troops over whose heads their fire may be directed. Types of machine guns are the Browning (heavy), Vickers, and Maxim.

The importance of distinction in the use of automatic guns can be no more accurately presented than in the language of W. D. Doc. 836, "Tactical Use of Machine Guns," A. E. F., France, 1918, where we find that "a clear understanding of the characteristics of machine guns is absolutely necessary to their correct tactical use. *A confusion of ideas as to their powers and limitations will lead to a failure to utilize them to the fullest extent, or to positive disaster by expecting from them functions which they are not capable of performing.*"[1]

EMPLOYMENT

The automatic rifle is primarily a platoon weapon and is incorporated in infantry organizations.

The machine rifle is fired from a light mount and, while capable of firing for a longer period than the automatic rifle, has not the mobility and cannot keep up with the infantry. Like the automatic rifle, it is susceptible of use only in direct fire and can never be employed as a machine gun.

The machine gun is mounted on a tripod, weighing approximately 50 pounds. The legs are weighted with sand bags, so no matter how nervous the firer, the rigidity of the mount entirely eliminates the personal factor.

The fire of a machine gun is equal to that of 100 rifles, yet the space occupied is as one is to fifty. It depends for effect upon surprise and likes a deep, dense target.

[1] Italics are mine.

The mobility of the machine gun depends greatly upon ammunition and water supply. Water is carried in breakers weighing (filled) about 12 pounds. It is essential that water be clean in order to prevent corrosion.

While the equipment of the machine gunners will not admit of keeping pace with infantry, it can be carried any distance and to any point reached by the infantry.

The machine gun is capable of rapidly producing and applying a large volume of concentrated and accurate fire. Because of its rigid mount it can employ the same types of fire as artillery. Nine-tenths of its fire is indirect, the most important type being overhead barrage fire.

Data is calculated for this fire in much the same manner as obtains in artillery, with the use of some adaptation of the mil formula, when a map is not available. Take the *TOG* method:

$$\frac{(t \times OT) - (g \times OG)}{GT},$$

When the target cannot be seen by the firer (No. 1) the machine gun officer, accompanied by the Range Finder Sergeant, takes up a position (O) where both a flank gun and the target can be easily seen, which position must be visible to No. 1. By means of the prismatic compass the slopes from O to target (t) and gun (g) are taken, and the mil bearings recorded. The angle of site is the algebraic sum of $(t \times OT) - (g \times OG)$. The angle of quadrant elevation is found by adding this angle to or subtracting it from the angle of tangent elevation (angle of departure) depending as the target is above or below the gun.

The ranges to target (OT) and gun (OG) are read, and the angle *TOG* plotted on a scale of about one inch to 100 yards. The triangle is then completed and the range scaled. The angle *OGT* is read, and No. 1 lays on O, turning off the angle found in the direction of the target. The elevation is then put on. Frontages of battery and target are paralleled and angles of concentration or distribution given.

Machine guns are always used in battery in this type of fire.

When one is available, the data is calculated from a map and recorded on charts similar to those appended. The most notable instance of the successful employment of indirect overhead barrage fire during the war was at the Battle of Messines, where 144 guns were used and nearly 3,000,000 rounds fired.

INDIRECT OVERHEAD FIRE SHEET

No. 165 M. G. Co. No. One section: Date, Sept. 13, 1918.
Map used, Verdun

ELEVATION								CLEARANCE					
Gun position Map location	Target Map location	Direction	Range to target	Contours Gun Target	V. I. plus or V. I. minus	Q. E. table	Range for Q. E. table COr	Contour of own troops	V. I. between gun and own troops	Range to own troops	Trajectory height table	Clearance obtained	Table of safety clearances
A12b 3036	B13d4706 to B14c0012	SE	2250	125M 112M	13M	320	2200	116M	8M	910	56	65	600–11X 700–13X 800–15X 900–17X 1000–20X 1100–23X 1200–27X 1300–31X 1400–35X 1500–40X 1600–46X 1700–53X 1800–60X 1900–69X 2000–80X
													Grid bearing of zero line.

BATTERY CHART. A BATTERY

Composition 1 and 2 sections, M. G. C. Frontage of battery 70 yards
Commanded by Lieutenant L. Brown. Grid bearing to R. O. 189°
Location of directing gun B7b8792. Zero line B7b8726 to A18d8460
No. of directing gun 8. Grid bearing of zero line 210°

No. of barrage	No. of guns	Targets	Clock time	Zero time	Angle of switch	Distribution angle	Range	V. I.	Q. E.	Range to F. T. when barrage lifts	Clearance when barrage lifts	Rate of fire
A	1 to 8	A18d8460 A18d2380	4.03 to 4.06	Z to Z+3	....	1°	1880	−2M	219	1425	30	100 pm
B	1 to 8	A18d8460 A18d3624	4.07 to 4.10	Z+4 to Z+7	....	7′	1880	−4M	208	1625	19	Do.
C	1 to 8	A18c7429 A18c2583	4.11 to 4.14	Z+8 to Z+11	9°30′	55′	2380	−8M	281	2025	60	Do.
....	8	7	6	5	4	3	....	2	1	....	....	....
....	0	1°	2°	3°	4°	5°	....	6°	7°	....	....	....
....	0	7°	14°	21°	28°	35°	....	42°	49°	....	....	....
....	9°30′ R	10°25′	11°20′	12°15′	13°10′	14°10′	....	15°	15°55′	....	....	....

GUN CHART

No. 4 gun. A Battery. Gun commander: Lieutenant A. Jones. Grid bearing of zero line

No. of barrage	Clock time.	Zero time	Angle from zero line	Q. E.	Traverse	Rate of fire
A	4.03 to 4.06	Z to Z + 3	4°	219	2°	100 pm
B	4.07 to 4.10	Z + 4 to Z + 7	28′	208	2°	Do.
C	4.11 to 4.14	Z + 8 to Z + 11	13°10′	281	2°	Do.

CHART OF CONCENTRATION POINTS

No. of point	Angle from zero line	Q. E.	Remarks
1	4°	219	Z + 2 to Z + 3

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ELIMINATION OF COUPLING TROUBLES IN MAIN SHAFTING

By LIEUT. COMMANDER J. K. ESLER, U. S. Navy

1. Continuous operation, or almost continuous operation of machinery at designed full power for any length of time is almost certain to disclose defects or weak parts of that machinery. Naval vessels, and many others as well, were subjected to these conditions during the recent war. While the percentage of vessels whose machinery was not equal to the continued strain was comparatively small, a number of vessels did require repairs of a more or less urgent nature. Some of these repairs were beyond the capacity of the ship's force, and it became necessary for these ships to go into dry-docks at navy yards. The repairs in dry-dock consisted principally of shaft repairs, and by far the greatest trouble with shafting, aside from routine re-wooding of bushings, etc., was experienced with outboard couplings. If these constitute a weak point, as they evidently do, it may be possible to improve them.

2. Since the adoption of marine machinery and propellers, the engine and the propeller have fought continually—the engine to turn the shaft, and the propeller to keep it from turning. This conflict of forces is nothing less than a great battle, with science and invention endeavoring to aid first one and then the other belligerent. In the meantime the shaft—as you may imagine—is "torn between two emotions." At one end the engine turns it, at the other the propeller resists the turning, pushing against it, and—driving the ship. The shaft, made up of sections bolted together with couplings, and supported in bearings throughout its length, is acted upon by an almost infinite variety of forces—forces tending to turn it, forces tending to compress it, forces tending to bend it, and (when the ship backs), forces tending to stretch it.

3. For this very reason shafts are constructed with ample allowance for strength. With slight variation for different types of installation, there are the following sections: main engine shaft, thrust shaft, one or more sections of line shafting, the stern tube shaft, and the propeller shaft. The couplings securing the end of these sections to each other, are of the same type for the engine, thrust, and line shaft sections, and consist of a flange shrunk or forged on each end of each section so as to be practically integral with it. These flanges are bolted together with through-bolts so that the shaft is continuous, with very little additional weight, and if anything, with greater strength at the couplings. The stern tube section is secured to the after end of the line shafting by a special sleeve fitting over the forward end of the stern tube shaft and bolted to the flanged end of the line shaft. This sleeve is kept from turning on the shaft by longitudinal keys, fitted between the shaft and the sleeve. It is prevented from pulling off, or moving lengthwise along the shaft, by a locking ring, or by segments of a ring, which fit into a grooved recess in the shaft. This construction is used so that the end of the shaft will not be enlarged, and so that the shaft can be drawn outward through the stern tube if desired. In some ship yards (Newport News, for instance), it is customary to force this sleeve on the shaft while heated. Any one can imagine the enthusiasm with which the task of removing one of these coupling sleeves is approached in a navy yard. One of the inboard couplings of the U. S. S. *Michigan* resisted all efforts for about a week, although a force of approximately 60 tons was applied, and the coupling finally had to be cut off, and a new sleeve forged. This coupling had been forced on cold, over a .003 inch, to .004 inch difference in diameter. These couplings do not, as a rule, cause much trouble in operation. The chief trouble develops when it becomes necessary to remove the coupling in order to withdraw the stern tube section of the shaft. The other special coupling, outside the hull, causes more trouble.

4. The coupling between the stern tube shaft and the propeller shaft is the heaviest, and probably the strongest part of the whole shaft. Owing to its inaccessible location, outside the hull and under water, special precautions have been taken in its design and construction. There are two general types in use. The one most in favor with naval men consists of a hollow cylindrical sleeve, tapered inside to fit a special taper on the ends of the shafts. Two

opposite longitudinal keys between the shaft and sleeve, keep each end from turning in the sleeve. Cross keys through each shaft, and the sleeve, draw the ends into the taper and keep them from withdrawing. This type gives general satisfaction, the only troubles experienced being due to keys working loose, fractures caused by too tight a fit at the sides of cross keys, etc. In the other type the sleeve is made in two halves, bolted together along the sides. The shafts are prevented from withdrawing by a single locking ring in halves fitting into annular recesses in both shafts and into a recess on the inside of the sleeve. Longitudinal keys keep the shafts from turning in the sleeves. A great deal of trouble has been experienced with this type, arising from crystallization of the bolts, in spite of the fact that the strongest materials, even class "A" nickel steel forgings, have been used. The importance of these couplings and their inaccessible location, make it essential that their design and construction should embody the best that mechanical science and experience afford.

5. An impartial "estimate of the situation" makes it clear—strange as it may seem—that the greatest trouble in shafting occurs at the heaviest and strongest part. It is possible that an investigation of the forces of vibration in the shaft will disclose the reason why this particular part should cause so much trouble.

6. Vibration may be divided into three general classes: transverse, longitudinal, and torsional. Different parts of the shaft are subjected to stresses in various directions. Each crank-pin of the reciprocating engine tends to force the shaft in a direction dependent on the angle of the cranks to each other. The shaft is restrained by bearings between each crank. The fact that these bearings are equally spaced along the shaft increases the tendency of the shaft to spring, the amplitude being equal to the distance between bearings, the nodes being at the bearings, and the frequency depending upon the speed of revolution. This tendency, started at the engine, travels through the length of shaft until it reaches the heavy outboard coupling, and this coupling is of such heavy construction that the vibrations are damped—absorbed. The end of the shaft tries in vain to shake itself free in the coupling. If the bearings are not in exact alignment, or if some are down more than others, there is a tendency for the shaft to sag or to be bent at these points. As the shaft revolves, it tends to bend successively to every part of its circumference. This causes

the same transverse vibration of the end of the shaft in the coupling sleeve. Moreover, aside from its weight, there is another factor tending to cause the vibrations to be absorbed in this coupling. The propeller, turning in water affected by the wake current of the ship, by currents diverted by the rudder, and by the greater pressure of water at the bottom than at the top, has tendency to spring the after end of the shaft. The supporting strut bearing is not tight; it permits slight play of the shaft. The transverse vibration, being dependent upon so many uncertain features, can hardly coincide with the vibrations in the remainder of the shaft, and these vary with the speed of rotation. Is it not natural to suppose then, with the propeller shaft trying to shake itself loose in one end of the coupling sleeve, and the stern tube shaft endeavoring to shake itself loose in the other, that great and unknown stresses are set up at this point?

7. As the propeller turns over, the force required to turn it and the thrust which it delivers to the shaft vary with the currents in the water in which it turns. This variation is for the most part periodical, and dependent upon the resistance encountered by each blade as it passes the points of unequal resistance. The thrust then becomes a sort of pounding, varying a little above and a little below the mean thrust delivered to the shaft. But the shaft is held from longitudinal movement, however slight, by the thrust bearing. Once the thrust collars are tight up against the thrust shoes, no further longitudinal movement is possible. *The shaft vibrates in length*, and this vibration is also absorbed in the outboard coupling. The stress exerted in the coupling sleeve may be likened to the action of a wedge subjected to vibrations. The tremendous force which may be exerted by a wedge is not dependent entirely upon overcoming skin resistance between the wedge and the faces it is forcing apart. The wedge itself contracts in length and expands in width on being struck by a sledge. It is evident that the pounding effect of unequal thrust in the shaft exerts a very similar stress upon the coupling sleeve. And in much the same way the inequalities in water resistance affect the uniform rotation of the propeller.

8. Thus, torsional vibration of the propeller shaft is due to unequal delivery of torque by the propeller, even though the torque delivered to the shaft by the engine is uniform, as in turbine and electric installations. What place in the shaft is most

likely to receive the full benefit of vibrations caused by momentary differences between the torque applied and the torque delivered? We conclude that the outboard coupling, because of the great weight concentrated on this one part of the shaft, absorbs almost all the vibration of the shaft. There must be some means of diverting these vibratory effects from this inaccessible location.

9. Is it possible to distribute the shaft vibrations throughout the length of the shaft? Would this decrease our shaft troubles?

10. To distribute the vibrations throughout the total length of shaft requires that the shaft be made practically uniform in weight and strength. The solid couplings used on line shafting give practically no trouble and have the advantage of parallel opposing faces to assist in checking alignment of the shaft. If these couplings could be used in place of the special outboard and inboard couplings now used, the shaft would be uniform in weight and strength throughout its length. The deterrent factor is the necessity for withdrawing the stern tube and propeller sections of shaft through the stern tube and strut bearings. Can the stern tube and strut be modified to permit the removal of these sections if fitted with flanges? They would have to be enlarged about 8 inches, in diameter. Clearly it is impracticable with ships with built-in stern tubes. But new struts might be fitted, This would eliminate the necessity for the outboard coupling. It is believed that the bushings which fit into the stern tube and strut to form the bearing for the shaft, could be fitted into a sort of distance bushing, about 4 inches thick, fitted to the inside of the stern tube and strut. These bushings would not be removed except when necessary to withdraw the shaft. It is more than probable that this is entirely feasible in future construction, and that the advantages offered to ships at present in commission may warrant the installation of new struts incorporating this feature, and eliminating the present type of outboard coupling.

11. This would mean, then, that for new construction, the stern tube would be about 8 inches larger in diameter, and that in each end would be fitted a distance bushing of brass, 4 inches thick, cored and ribbed for lightness and strength. The familiar wooded bushings would fit inside the distance bushings in the same way in which they now fit in the stern tube. The struts would be changed in the same way, except of course, that only

one distance bushing would be required for each strut, while two would be required for each stern tube. This feature of construction is suggested as a means of distributing the vibration throughout the full length of the shaft.

12. It is, of course, possible that more thorough investigation and experiment may disclose some better method. But before we attempt to estimate this possibility, let us consider the remaining factors.

13. First, reduction of vibrations caused by the propeller would seem to be improbable. Many types of propellers have been used in the navy. The present type is the result of endless calculation, experiment, and trial. The vibrations which originate at the propeller are not caused by any fault of design or construction. They are the result of unequal areas of pressure of water against the blades, and it is extremely doubtful if any means will ever be provided to improve this condition.

14. Secondly, while the vibration caused by the engine has been reduced to what approaches a minimum, there still remains the shaft vibration, which no engine design can eliminate. Yet the more modern the engine, the more imperatively does its increase of power demand the elimination of vibration. Great strides have been made toward eliminating vibratory stresses caused by the engine. The newer installations, turbine direct connected, turbine with reducing gears, and electric drive, all provide a uniform torque and practically no transverse pressure on the shaft. These advances in main engine installation, however, bring increased power as well, and while the general result has been a great improvement in shaft vibration, the newer installations require even less vibration that at present, for more satisfactory operation. It is readily understood that an old reciprocating engine will " mote " even if the shaft is shaking around a good deal, while a high speed turbine or an electric motor would rack itself into pieces under the same conditions. This only serves to illustrate the difficulties attendant on the " war problem " confronting engineers at each step of progress in marine engineering. To revert to the conflict of forces, amounting to a continual battle between the propeller and the engine, we may say that the engines now have the advantage. There is no improvement in sight for the propeller. The only way in which progress can be facilitated appears to be by improvement in the shaft.

15. The causes of shaft vibration have been treated very briefly. It has been shown that torsional and longitudinal vibration do not disappear with uniform application of torque. It is to be expected that vibration will be present in future installations, though it will undoubtedly decrease as installations become more mechanically perfect. If this vibration can be distributed throughout the total length of shafting, whether by the method of eliminating concentration points at heavy couplings, as suggested in this article, or by some other practicable method, it is certain that the many difficulties experienced with present shaft installations will be greatly minimized, and some at least, will be completely eliminated.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A WRINKLE IN TACTICS

By Lieut. Commander R. F. Wood, U. S. Navy

1. Among the maneuvers most frequently encountered is that wherein the line of bearing of ships is altered.

2. It is well known that if you are the leading ship in column and are ordered to take position on the bow of a ship in the column astern, that you readily reach the designated location by turning to that side by an amount equal to the bearing assigned. Maintaining standard speed, your distance from the guide remains the same.

3. Fig. 1 shows this condition graphically.

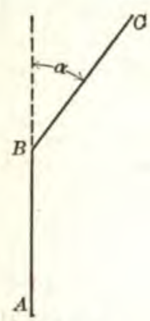


Fig. 1.

4. If B changes course by the given bearing a she will reach C at the same instant that guide A advances to point B. Thus B has reached a new line of bearing at the standard distance using standard speed.

5. It may not be so generally known that a like relation obtains when the ship ahead happens to be on a line of bearing other than 0°. Such however is the case, and by the use of this knowledge

a simple thumb rule will suffice and instead of the necessity for the use of the mooring board, the desired change of course is had instantly.

6. Referring to Fig. 2 the problem may be stated.

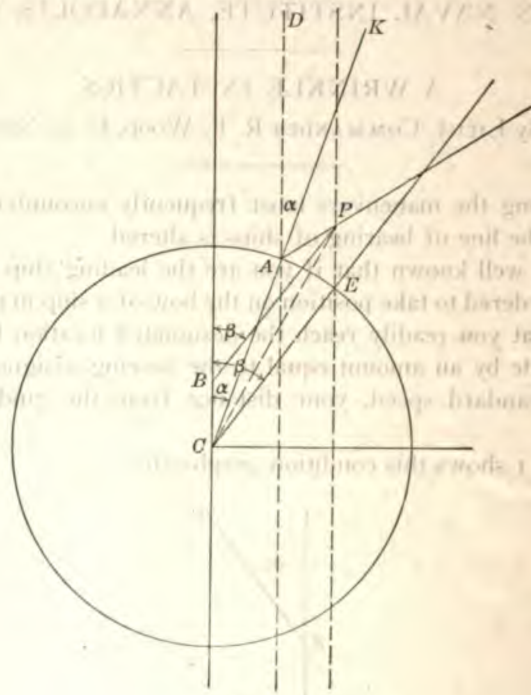


FIG. 2.

7. Ship at A, distant CA from guide C and bearing from the latter angle α, desires to reach a position bearing angle β from guide at a distance equal to former distance CA. Assume equal speeds.

8. Let ship stand on such a course from A that at a given instant she arrives at a point which bears angle β from guide at distance required. Call this point P.

9. In the figure CB and AD represent the original course. Angle DAP is the angle between original course and course to desired point P. We wish to find a value for angle DAP.

10. Draw CP.

11. Then in triangles CBP and CAP

$CB=AP$ (for at equal speeds C moves to B while A moves to P).

$BP=AC$ (P being such a point that it bears angle β from guide at same distance as before).

$CP=CP$ (being common to both triangles).

Therefore triangles CBP = triangles CAP and

Angle CBP = angle CAP.

But angle $CBP = 180 - \beta$ = angle CAP.

and angle $CAP = 180 - KAP$.

Therefore $180 - KAP = 180 - \beta$.

Angle KAP = angle β.

But angle DAK = angle α (Ext. angles parallel lines).

And angle $DAP = DAK + KAP$.

Therefore angle $DAP = \alpha + \beta$;

which value was sought.

12. So, at same speed as guide, to move to a new bearing from guide greater than that already held, at same distance, simply change course away from guide an amount equal to the *sum of the old and new bearings.* Should this angle be greater than 180° it is simpler to subtract from 180° and turn toward the guide by this amount.

13. In practice the arrival of the ship at P is determined by the use of the pelorus, checked by the rangefinder for distance, the ship turning up to her course just before the bearing and distance are obtained. For runs of some distance the time required is quickly found by multiplying the distance between tracks by the cosine of the change in course and dividing by speed.

14. Those interested will find the above rule to apply also to some cases where the bearing is altered from one bow of guide to the other, or from one quarter to the opposite. However, in doing any of these stunts do not forget that the guide is a ship and not a point on a line.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MODEL MAKING

By COMMANDER C. S. MCDOWELL, U. S. Navy

FOREWORD

It is probable that many officers in the navy have, while in London lately, seen the races, on Sunday, of model yachts in Hyde Park and investigated the subject sufficiently to discover the wide interest and enjoyment which is taken in this sport by large numbers of people in England. It is not improbable that the greater interest in boating and water sports and pursuits, as compared to this country, which is found in all classes of society in England, has been fostered and encouraged, by model yacht building and racing.

At the present time there are many officers and men of the naval reserve who have returned, or are about to return to civil life. Many of these have acquired a certain knowledge and interest in the sea, which they would like to retain.

In the navy, to obtain the name of a " smart ship," the crew must be instilled with a ship's spirit based on common hopes, experiences and traditions. With the frequent changes that have been necessary, of late, in personnel especial efforts are required and should be made to obtain such a spirit. A " smart ship " used to be identified by the smartness of her boats, and ship's spirit was encouraged by sailing and pulling races. While, under present service conditions, it is not possible to devote as much time as formerly to boat drills and boat racing, it is possible on ships of every class to build and race models. Thus races may be held between divisions as well as between ships, and by requiring all model yachts to be home-made an interest in the sport is afforded and much useful knowledge acquired.

With the thought that this subject might be of interest to those who have seen something of the navy and acquired some of the

spirit of the sea, and have now gone back to civil life, as well as to those who remain in the service, a few notes on model making have been written up at my suggestion by Ensign Lewis F. Herreshoff, U. S. N. R. F., of the well-known firm of yacht builders.

HISTORY

Model making as far as is known dates back to the Egyptians, and the art was practiced throughout the ages in all nations, as

FIG. I.

may be seen by the wonderful examples of model making in various museums. In our own country, such museums as the East India Society in Salem, Mass., and the Historical Society Museum in New Bedford display models, some of which were made at sea. One of the best of them all is a little bone model made by Yankee sailors, while prisoners-of-war in an English prison during the Revolution. It is said to be made from beef bones saved from the food, and is certainly a very fine piece of work. Evidently there were many sailors in the years gone by who could make exact duplicates of the ships they had manned, and it

is believed that there are also men to-day who could do the same if they were properly encouraged. It certainly would make them take a keener interest in their own ship, and give them a higher regard for material and a greater pride in their ships than is now the case in our navy. A model of one of the old sailing ships is shown in Fig. 1.

TYPES OF MODELS

Generally speaking, models can be divided at the present time into four classes, which may be described separately as:

(1) Exhibition;
(2) Sailing;
(3) Power; and
(4) Experimental and Designers' Models.

Exhibition models are, of course, small reproductions and should be built to scale since nearly as much depends upon the exact proportion of parts as upon the workmanship, for, no matter how fine the work, the effect can be entirely spoiled by some part that is not to scale. There is no limit to the amount of fine work that can be put in on an exhibition model; and in making one it should first be decided how much detail the amount of time to be spent, will allow, and what the tools and skill of the builder will be capable of accomplishing. The best material for the larger parts such as the hull, deck houses, etc., is well-seasoned pattern makers' soft pine. The smaller parts, such as rails, hatches, spars, etc., can be made of some hard fine-grained wood such as mahogany or boxwood, or, if desired, ivory. The very small pieces should be made of metal and can be painted to represent any material. The kind of glue used is very important, for it often happens that glues of the fish variety are not reliable. For most work, however, "Amberord" will be found satisfactory. Pins are useful for small fastenings, and especially very small ones, called ribbon pins. The tools for this class of work luckily are all small, and requiring little room, they can be conveniently stowed.

For those who are interested in engineering perhaps there is the largest field of all, for there is nothing more attractive than a model steam engine.

There are no small fittings or parts for model work now made in this country, although there are several firms in England who

can supply nicely proportioned and perfectly practical fittings of all sorts, engine parts made to several scales and every sort of deck fittings.

SAILING MODELS

Sailing models afford much the most fun, for they are nearly as good for racing as full-sized boats. They must, however, be of quite different proportions from large boats, as they have much greater speed in ratio to their length. The wind would be almost a hurricane as it is not reduced with the size of the model. Consequently, sailing models must have as straight lines as possible, much reduced sails, and deeper keels. They also should be of

FIG. 2.

certain proportions as to depth and width of hull, so that the curve of the lines that run under the bottom may be of about the same radius as the ones along the sides, because when the boat keels over a change in her lines is apt to make her try to turn to one side. For example, a wide, shallow-hulled boat will head up when she keels over, while one of the deep, narrow or cutter type will invariably swing off. A good example of a sailing model is shown in Fig. 2.

Concerning rules for measurement, probably the simplest is that limiting the sail area; for all other rules are apt to produce types that are exaggerated in some dimensions which are not measured.

FIG. 3.

FIG. 4.

White pine is the material generally used for the hull, and the most satisfactory construction seems to be the so-called "bread and butter" system, which consists of layers of boards cut out to shape, corresponding to the different water line elevations and glued up in correct order. The interior of the upper and larger layers can be cut out and used for the lower layers, thereby saving much labor in hollowing out. The gluing up of the different layers must be carefully done, and a good glue for this purpose is made by dissolving gelatine with hot water until about the consistency of cream and then adding a tablespoon of acetic acid to pint of this solution.

NOTE.—Ready-cut blocks for making models of several scales can be bought from William Richards, 1836 Park Avenue, New York City. For the latest practical ways of laying decks, making spars, sails and steering gears, one may refer to the handbook "Model Sailing Yachts" published by Percival Marshall & Co., London, and sold in this country by Spon & Chamberlain, 1235 Liberty Street, New York City. Small fittings for sailing models can be bought from Bassett Loke, Ltd., Kingswell Street, Northampton, England.

A good, properly designed model of any size over thirty inches will sail in the roughest water nearly as well as in a smooth pond. Thus it is practical to sail them almost anywhere so long as they can be launched and picked up without damage. Figs. 3 and 4 show model yachts racing in New York City parks.

There are several model yacht clubs in this country, the most active of these being near New York City, and including the "Prospect Park Model Yacht Club," the "Yankee Model Yacht Club" and the Club at Central Park.

POWER MODELS

Power-driven models have been very popular in the last few years. The electric driven ones have been developed considerably and are fairly fast, there being now on the market very small, large capacity, dry cells and very good small motors for those who wish to make fully equipped battleships, destroyers, etc. There have also been built some well designed gasoline-driven models, but these present many difficulties in their construction. For instance, the spark plug has to be quite out of proportion in order to make the insulator thick enough so that the spark will not jump across. Also,, the small carburetor must be of different

construction than is the practice with full-sized engines. A power-driven model boat is shown in Fig. 5.

For those who are looking for speed the steam-driven boats have been fairly in the lead during the last few years. Most of these boats are of the extreme hydroplane type, are about 40 inches long, weigh less than eight pounds, and are driven by a two-cylinder, single-acting engine of $\frac{3}{4}$ of an inch bore and stroke. These have a flash type boiler which consists of a coil of five-sixteenths of an inch seamless steel tubing of about 20 feet length, so coiled that it goes inside of a boiler casing about four inches diameter by 8 inches long. The heat is generated by a powerful gasoline blow-torch and these boilers generally carry a pressure of over one hundred pounds of highly superheated steam. It is

FIG. 5.

possible with some of these models to make the amazing speed of 25 miles an hour. There is at present very keen competition over the speed record of boats of this type.

NOTE.—Photographs and accounts of some of the fast American boats of this type have been published in the *Every Day Engineering Magazine*. The English boats have been described in the magazine *Model Engineering*, which is sold by Spon & Chamberlain, 120 Liberty Street, New York City.

EXPERIMENTAL MODELS

Models for experimental work have been used by all of the best naval architects in the world, and through their use new types of ships have been developed at little expense. Nearly as accurate comparisons of resistance can be made by any one in a

power boat as those arrived at in the model basins, by simply making models of exactly the same weight and towing them in pairs from a carefully balanced yoke held out from the side of a power boat on a pole.

Designers' models are generally made half breadth and are used for obtaining measurements for calculation, laying off plating, etc., and most of the best shaped ships have had their building measurements taken directly from a model.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

RESPONSIBILITIES AND DUTIES OF NAVAL OFFICERS OF THE UNITED STATES IN EDUCATING AND INFORMING THE PUBLIC ON PROFESSIONAL MATTERS

By LIEUT. COMMANDER V. N. BIEG, U. S. Navy

The suggestion by the Board of Control of the Institute that an article be written on the above subject would seem to be exceedingly timely just now, when public opinion is aroused in military matters and there are so many questions of a military nature under discussion.

A mere glance at the title must, in the case of numerous officers in the service, cause crystallization into a definite idea of those vague and indistinct thoughts on this subject, which by the very nature of service surroundings and experiences impress themselves at some time or other on their minds. It is as if a guiding hand directed a finger groping in the dark to a push button turning on a flood of light so that what has only been flittingly and indistinctly seen before is made plain and clearly defined.

That deplorable ignorance exists regarding the very *raison d'être* of the navy, its character, its war and peace time work, its thousand and one varied activities, even its uniform, is a commonplace and cannot be denied. Indeed, manifestations of this ignorance come to the attention of naval officers almost daily. Of course, it must not be understood that the writer is on this account attempting to assume the rôle of an accuser; it is the intention merely to point out how prevalent is this ignorance and to show how momentous a matter in its larger aspects it really is.

It is concerning the employment of the navy in war and peace; the fundamentals of strategy; the work of the fleet, its character and amount; its organization; its various industrial activities; the reasons for its vast money expenditures, etc., where ignorance if it exists does so much harm to the navy and the country. Two

from sea coasts and living a life that would not naturally suggest the navy to mind, should be kept informed of the whys and wherefores of the navy.

This duty must necessarily devolve upon naval officers, who are the specialists in this particular instance.

There is a point in connection with the intelligence given out which should be emphasized. It should come only from men who are known to be reliable. This is so apparent as to make this statement appear ridiculous. But what do we see on every hand, in the case of many civilians asking about service matters? Some bluejacket just discharged is asked for his opinion on the battle of Jutland, on the value of the battleship now that the submarine has developed to such an extent or on any number of questions no less momentous. The writer has writhed in agony many times while listening, unwillingly, of course, to some ignorant man or officer expounding false theories in all seriousness, thereby doing irreparable harm and impairing confidence in other officers and men of more repute.

There are many legitimate methods of disseminating knowledge relative to the navy, almost all of them cheap and requiring no cumbersome or new organization.

The best method it is thought would be widely to advertise the NAVAL INSTITUTE PROCEEDINGS, reducing the subscription price as the circulation grows, and requesting articles from civilians and suggestions for titles to articles which would bring out questions of interest to them. It is apparent that this method has great possibilities and is entirely feasible, for it was not long ago that through the agency of the Institute a prominent civilian asked for and received valuable information on the much discussed question of the relative value of one large ship as against several small ones aggregating in cost a like amount. This was accomplished by the offer of a price for the best article to appear. An excellent treatise was the outcome and so convincing as to abrogate all doubt on the subject and which fully substantiated the present policy of the General Board. The offer of a prize, of course, was quite incidental, and if request had been made the article would undoubtedly have made its appearance without it. There is no attempt here to suggest that such a procedure should be followed as a general rule. It merely serves to illustrate that

there is a large and fertile field for those in the service whose efforts are directed towards its betterment and a closer relationship with its supporters.

Some other methods which could be used to advantage are suggested, although the list given below is by no means exhaustive.

Co-operation with the Navy League along the same lines as recommended in connection with the Institute.

Co-operation with accredited members of the press.

Lecturing by accredited officers located in vicinities where particular interest is taken in any phase of naval activity.

Constituting an officer on each ship a departmental agent for the purpose of receiving press correspondents or delivering lectures and organizing display parties on board ship. In connection with this method it might be stated that it is only in this manner that a general policy in the discussion of naval affairs can be assured, and also those topics which should be reserved from enemy ears or which should not be openly talked of would be more closely guarded, by reason of the personnel charged with publicity being under direct control of the Navy Department. The higher the rank of the publicity officers, of course, the better. Another thing to be said in favor of this plan is that if the civilian knew that there were certain accredited and reliable officers detailed by the authorities for the above purpose, there would be very little of the haphazard gleaning of information often so false and harmful, which has been spoken of before.

Regarding publicity in any form there is only one danger that can be foreseen. It is to be feared that in some instances it might be resorted to in order to gain political advantage; this, however, could easily be eliminated by a direct stipulation that neither personal nor individual ship accomplishments should be the subject for advertisement. At any rate, on this particular point it is not so much a question of preventing a new evil as it is of limiting one already in existence. With one and only one person on each ship or station responsible, such matters could easily be traced to their source.

There is a host of subjects, which should be given publicity through discussion, lecturing or written articles, that pop up in the writer's mind, but as it is manifestly impossible to expatiate upon them here and as indeed this would be out of place, intima-

tion only of the type of topic the consideration of which would give a start to the whole scheme, herein outlined, will be given in the following list.

The relation of the navy to the government showing that it is a force not merely for the sake of force but for the purpose of attaining a certain object that the government must attain, after diplomacy has first been tried, but has failed.

An article explaining in plain terms and by simple examples the elements of strategy and tactics; particularly showing where these matters concern the civilian and the government and that these subjects are not dry, half dead theories, but are living and pertinent issues every day in the year.

Another setting forth the reasons for and the values of the different types of ship, laying especial stress on the value still retained by the major type of ship despite the tremendous development of the submarine. The fallacy of the small ship idea, etc.

A fourth on the navy's industrial activities, would, it is believed, be of particular interest to the civilian whom the writer has heard time and again ask for information on this subject. The points generally brought up for discussion are the reasons for the greater overhead expense in the navy operated plant, the apparent waste, etc. The difference in the end sought and the necessarily different point of view should be emphasized, the uncertainty of availability and shifting of ships due to uncontrollable circumstances, the cancelling of plans half finished due to this unforeseen shifting, etc., etc. Setting forth that the greatest efficiency experts have tried a hand at bettering conditions with but little, if any, success and pointing out that suggestions are thankfully received.

An exposition, profusely illustrated, of the work the service does with a comparison of hours of actual employment, wages, the kind of existence undergone, etc., laying particular stress on the hard and dirty work which is at the present time little known to the outside world. In articles heretofore there has been too much devoted to clean, immaculate quarter decks and long lines of bluejackets on parade, which misrepresents to a cruel extent the true nature of the navy's work. Pointing out that Saturdays and holidays when visitors are generally in navy yards and aboard ship, is no time to judge of the nature of the work that is performed normally.

It seems that a discussion of the work of the reserves, their value, their weaknesses, their peculiar position in the navy as against their status in the army, etc., would be particularly timely.

Effective articles could be written in answer to some of the questions which are so often asked as to be standard and the joke of every ward room.

What do you watch for when you go on watch?

What do you do all day?

How nice it must be to yacht on a destroyer.

There is no attempt here at the last to be facetious, nor would there be in an answer to these questions any indication of hurt feelings. That such questions are asked wholesale by the civilian is a very serious matter, and one that will not admit of trifling. It is a sure indication that the work of the service is not only not appreciated, but that it is undreamt of. The personnel of the navy, and the Lord too, know that its work is fully as exacting in physical and nervous strain as that of any other profession, either in war or in peace. The failure of the public to realize this fact has led and will continue to lead, unless some corrective measures are taken, to lack of sympathy and support.

In conclusion, it must be admitted that an exchange of ideas among the civil and military could not be held without occasional spats and ruffling of feathers on both sides. However, it would certainly be of the utmost value, alike to both, and it is by this means alone that the idea of sides now existent, can be eliminated and a new idea of co-ordination instituted which will weld all into an inseparable team. By the latter means only can we hope for that solidarity of support so essential to the efficient operation of the main stay of the nation's honor, integrity and security: ***our navy.***

DISCUSSION

A Few Notes On Alternating Current

(SEE PAGE 1171, WHOLE NO. 197)

LIEUTENANT ELLERY W. STONE, U. S. N. R. F.—While Lieut. Commander Anderson's purpose in presenting an elementary paper on alternating current is an excellent one, several statements are made in his article which may bear criticism. They will be taken up successively below.

In Note 5, Mr. Anderson regrets the lack of text books which avoid the use of calculus in the presentation of the elements of alternating current. His attention is invited to the treatise on alternating current in Book Four of the Hawkins Electrical Series and to Part Two of Sheldon-Hausmann's "Dynamo Electric Machinery" in both of which he will find the matter presented in simple and lucid style.

On page 1173 of his article, he defines high frequency as being frequencies in excess of 100,000 cycles. From this, are we justified in assuming that a current of 50,000 cycles is of low frequency? As a matter of fact, the terms "high" and "low" can only be used relatively, and certainly may not be employed to draw a sharp and definite line of demarcation between currents of different frequencies. When quenched gap sets using 500 cycles were first introduced into this country they were often termed, and quite properly so, "high frequency" transmitters in contradistinction to the 600-cycle sets previously in use. Yet Mr. Anderson's definition would place all frequencies less than 100,000 cycles in the realm of low frequencies.

On page 1194, he correctly states that when a tone is of more than 20,000 vibrations per second it is inaudible, yet on page 1174 in his definitions of radio and audio frequencies he makes 20,000 *cycles* the upper limit of audibility. Since each cycle of alternating current produces two clicks of a telephone receiver, *i. e.,* one for each alternation, it will be seen that his second value is twice the first, for a current of 20,000 cycles will sound a pitch of 40,000 in a receiver. In radio engineering, it is customary to make 10,000 cycles—20,000 alternations—the dividing line between radio and audio frequencies.

On page 1175, the statement is made that there are two conceptions of the electro-magnetic induction of potentials but the distinction between the two is erroneously drawn. The two illustrations given are identical. There is but one requirement for the generation of electric potentials by electro-magnetic means and that is that there be relative motion between a conductor and the lines of magnetic force about it. The turns of the secondary of a transformer are cut by the expanding and collapsing lines of force due to the alternating current in its primary quite as effectively as are the armature coils of a generator by the flux of its fields. If there

are two conceptions, we should expect to find two fundamental formulæ for the generation of potentials but there is, of course, but one—applicable alike to generators and transformers.

The "sine" curves shown in Figs. 2 and 9 are not sine curves but series of straight lines joined at their extremities by curves. A table of natural sines will show that a straight line variation of the sines of angles of widely different sizes does not obtain.

In the first paragraph on page 1190, the statement is made that reactance depends upon the frequency of the current, for it increases with the rate of change of current. This should be qualified to show that it is inductive reactance to which the author alludes, for condensive reactance decreases in value for increase in frequency. Further on in the same paragraph, Mr. Anderson states that "as the rotor gets up to speed and the frequency becomes less, more currents are sent through the low resistance winding." This would seem to indicate that two resistance windings are supplied, one of low and one of high resistance, whereas, as stated in the beginning of the paragraph, but one resistance winding is supplied. "Impedance" should be substituted for "resistance" in this sentence. To be correct, this paragraph should be written as follows:

"The double squirrel cage has two windings that parallel each other but are not connected. One is high resistance, the other is high inductance. The reactance, and hence impedance, of an inductance depends upon the frequency of the current, for it increases with the rate of change of current. Therefore at starting, the frequency being the greatest, there will be a maximum impedance of the inductive winding with the result that most of the currrent will flow through the resistance coil due to its lower impedance. As the rotor gets up to speed and the frequency becomes less, the decreasing reactance of the inductance will cause its impedance to become very much less than that of the resistance winding, so that practically all of the current will flow through the inductance. In this type of rotor, then, the insertion of starting resistance is automatic."

In Fig. 11, the customary resistance in series with the arc and generator has been omitted. If connected as shown, the generator would be practically short circuited by the arc, as the resistance of the blow-out magnets, which are wound with heavy copper wire, is not great enough to sufficiently limit the arc current. This resistance is often called the "ballast," which term Mr. Anderson appears to have applied to the ground.

In the first paragraph on page 1195, the statement is made that each wave train as it comes in gives one impulse. If this be true, it is not clear why the current must be *rectified* in order to make one click of the telephone diaphragm from one impulse of incoming signal current. Actually, the frequency of the incoming current is inaudible and is determined by its wave length. This holds true whether the waves be damped or undamped. The wave train is rectified in order to charge a condenser with recurring direct current impulses at radio frequency, just as alternating current must be rectified in order to charge a storage battery. The summation of these unidirectional charges is discharged once per wave train into the telephone receivers, but it should be noted that the change

from radio to audio frequency occurs after rectification—not before. The number of discharges of the condenser per wave train is unity, the number of charges per wave train is equal to the number of waves in the train which depends on the damping or logarithmic decrement, while the *rate* of charge of the condenser depends on the frequency.

If the same method of reception were applied to undamped as to damped waves, we should have one click of the telephone receiver for each depression of the transmitter key since one wave train is radiated for each dot and dash sent. Accordingly, as stated by Mr. Anderson, beat reception is necessary for receiving undamped waves.

Trajectories and Their Corrections

(SEE PAGE 1375, WHOLE NO. 198)

COMMANDER E. F. EGGERT.—In this article the author refers so frequently to my article on a similar subject, making comparisons between the method described therein and one by Professor Moulton, that he imputes to my article a purpose quite foreign to it. It seems therefore fair that I should endeavor to place my article in its proper relation to ballistics.

It happened that the Board of Control followed my article by a special statement, generally to the effect that during the war it had been obliged to publish practically any material received, however worthless. I should regret it very much if my article could not rise above that mediocre plane, but perhaps that is where it belongs; nevertheless, when general condemnations are being passed around, one always hopes that perhaps after all the other fellow was meant.

Since the present article draws in my method as a proving-ground method, it is only just to me to show how the method came to originate, and what its purpose was. Had time and opportunity permitted, no doubt the method could have been developed for proving ground use also, but such was not its original purpose.

A few years ago, being interested in inclined armor protection, I obtained a copy of the Bureau of Ordnance range table for the 16″/45 gun intended for the *Maryland*, the first type to mount guns to give 30° elevation. To determine still greater ranges than this table contained, I plotted and endeavored to exterpolate the results, only to find that the curve was very flat at the end, an evidently impossible result. The range table was wrong, and the information therefore of no use to me for design purposes.

I had done no ballistic work since my Naval Academy days, and did not know whether the methods then taught were still in use. I obtained therefore a copy of Alger's latest work for the Academy, and found that the 16-inch range table was indeed made by the old Alger method.

What I wanted to know was whether the 16-inch gun was really much superior to the 14-inch gun at a given long range, what the approximate difference in range, for a given elevation was, and what were the final velocities and angles of fall; it was only such general questions I wanted answered, and not questions of difference in range due to a variation from standard conditions.

Being fairly familiar with mechanical integration, from study in other directions, I began to apply it to this subject, since the difficulty in integration was the chief trouble with the Alger method. It took considerable time to get far enough to use it, since the subject was nothing more than a means of amusement in my idle hours, and, moreover, one stationed here is fairly out of the world, and thrown entirely on his own resources. The new method gradually came to a working basis, however. Then many months elapsed before I had computed, and often recomputed, enough trajectories to answer my immediate purpose. I was then so struck by the great amount of the correction necessary in the Alger method, that I determined to publish the results, more to indicate the possibilities of mechanical integration, and to call attention to the great errors in the old method, than to claim finality of precision.

My own method having now been put in its proper place, it might be permissible to say a few things in criticism of the other method, even though it was developed by a professional astronomer, of long experience, and with a large staff, unlimited time, and great experimental facilities available.

To begin with, the Moulton method is distinct from the Bliss sequel, and the former accomplishes only the same thing that my own does. It is in fact identical with it in most details. The chief difference is in the use of second differences, which I neglect. The effect of these is, however, easily determined by a short subsequent correction, if needed, but for most purposes the difference can be neglected.

That I used Mayevski's equations in my article has no bearing on the method. It was the latest information the navy had at the time my article was prepared. Whether the present accepted resistance results are more precise has yet to be proved, but at any rate the difference is not very much.

To revert to the example shown by Lieut. Commander Kirk, which is the same trajectory as given in my article, I have recomputed this, using the new resistance tables, with the following results:

Method	Range
Siacci	20,000
Eggert, original	19,931
Moulton	19,910
Eggert, new tables	19,949

These are all uncorrected for ΔR, and it appears that the difference in the range, due to the difference in the tables, is 18 yards.

Lieut. Commander Kirk has neglected to correct his range for variation in the amount of g. The actual mean value of g in this trajectory is 32.151, but he has used a uniform value of 32.185. The difference accounts for a variation of range of 18 yards, to be added to his value, making it 19,928 yards.

Correction for second differences shows that in this case the range is increased by less than a yard. The remaining difference between the ranges, as given by the two methods, is then 21 yards, and it is due to accidental errors of calculation, probably caused by small differences in the tables.

The author, on page 1384, states that with so large a ballistic coefficient, and at so short a range, there would not be much variation between the two methods. We have usually to deal with such large coefficients, but, when we calculate trajectories for small-arms projectiles, then, as I had already stated, a shorter interval than one second may be necessary. As regards the short range, it need only be said that, for one-second interval, the second difference correction is but eight yards at 37,000 yards' range.

Comparing the two methods, it can easily be maintained that the Moulton method is by far the more cumbersome. It would be conservative to say that it takes twice as long as the other. The apparent precision is hardly worth while, since we all know that, after making all possible corrections, we still have a mean dispersion in range, on actual firing, of from 40 to 80 yards, and we know also that actual measurements of ranges, when made by different methods, vary by 10 to 20 yards. The small integration error is swallowed up in this much larger error in firing, and of course the actual error of any one round may be much larger.

Now as regards the Bliss sequel to the Moulton method. This is a calculation to obtain differential equations, to correct the trajectory, and for proving-ground purposes something of the kind is desirable. As stated by the author, however, the calculation is as long as that of the original trajectory, and as it is of an entirely different character, and requires a new form, it is an awkward complication.

Most of the variables can be corrected, as I have indicated in my article, by a simple equation of the form, $s = \frac{1}{2}\alpha t^2$, where s is the correction in X or Y, due to a change α in the given variable, for the time of flight t. This correction can be determined in a minute, with a slide rule. In this way there would be handled changes in diameter or weight of projectile, in coefficient of form, in density of air, in gravity, or in resistance of air, the mean change in these cases being used.

Changes in range, due to variation in angle of elevation, are readily handled, as in the oldest method, on the principle of the rigidity of the trajectory.

Except for wind effect, this leaves only change in initial velocity to consider. There is no way of correcting for this, by my method, except by recalculation of the trajectory, with a new velocity. To do this, however, requires only one recalculation, and the two calculations will take not more than as much time as is required by the Moulton method for the original trajectory, besides being a check on each other, and a new form, with its distinct method, is avoided.

Coming to wind effect, although the Bliss method includes a correction for wind, the correctness of the principles involved is in my opinion much in doubt, and the results are open to question. We are still far from knowing the effect of the wind, and we still have much to learn by experiment. Much of what has been assumed the effect of wind is undoubtedly drift, and until we can make projectiles that are and remain dynamically balanced on their axes, and that rotate in exactly the same way, we cannot hope to solve satisfactorily the question of either wind or drift, which are closely related.

To return to the question of time required in my method, it should be noted that in the last paragraph of the body of my article I referred to the use of an interval of two seconds for ordinary large-caliber trajectories. This is really the best interval, and, for the 20,000-yard trajectory illustrated, takes up but half the space shown, and half the time. It can be corrected, just as for a one-second interval, for integration error, so as to give the same precision, and thus is both easy and accurate.

The correction referred to, for second differences, is carried out as indicated below. Taking as example the first integration, that of r_h, it appears that we have neglected to subtract in each case one-twelfth the second difference. The last value of V_h should therefore have *added* to it one-twelfth the summation of all the second differences in the r_h column, multiplied by the interval, in this case unity. This summation is nothing but the arithmetical difference between the first and last first differences in this column. In the example in my article, the first of these first differences in 4.1, and the last is .2. The difference 3.9, divided by 12, or .3, should be added to the last value of V_h. The effect of this error in V_h on X, is found by multiplying by half the time of flight, since half the error can be taken as the mean error in the velocity, and the resulting correction in X is +4.8 feet.

The correction of the integration in the V_h column is effected in the same way. The first of the first differences is 63.4, and the last is 23.0. One-twelfth the difference is 3.3, which is the effect on X, and must be subtracted. The total of these two corrections is +1.5 feet.

In the same way the effect on Y is determined. We find the mean error in V_v, from their r_v column, and the integration error of the V_v column. The first is +.05, causing an error of 1.6 feet in Y, and the second is —1.8, or a net reduction of the last value of Y or .2 foot. This is multiplied by cotan. ω to get the corresponding error in X, which is —.6 foot.

We find therefore that the error in X is composed of an error of +1.5 feet due to the X integration, and of an error of —.6 foot due to the Y integration, or a final correcion in X of +.9 foot. It should be noted that the variations in velocity are not great enough to cause secondary corrections in r.

When the interval is two seconds, the method is similar, proper use being made of the interval.

In discussing precision of calculation, the precision of measurement must be a guide, and there is no use in carrying precision farther in calculation than in measurement. Since the error of measurement is greater than these errors of integration, for a one-second interval, with ordinary large projectiles, there is not much gained by applying the correction. There is besides some uncertainty in the basic tables, and it is well known that the coefficient of form is not a constant.

Since receiving the new tables of air resistance and air density, I have changed that part of my method which requires curves of these values, and have computed convenient tables of these values. All this material is arranged on the two adjoining pages of a notebook, for values of r from zero to the resistance at 6000 foot-seconds, and for values of the

density to a height much beyond my present requirements. These tables accelerate the work considerably. Their place, in the Moulton method, is taken by tables covering 12 pages, to give a precision that is entirely useless. This will indicate how cumbersome the method is.

Opposition to Sane Sport in American Colleges

(SEE PAGE 1369, WHOLE NO. 198)

LIEUT. COMMANDER K. C. McINTOSH (S. C.), U. S. Navy.—Mr. Frank Angell opens his argument with the following: "My point is that this grinding drill takes out of a sport its essential element, which is the enjoyment of the player. . . . ."

There is no sport of any kind which has come under my notice in which anything approaching success may be attained without "grinding drill" of a more or less monotonous character. There is certainly no sport which has a greater individual element therein than golf, and no sport which gives the player greater freedom to stop when he is tired or disgusted or out of temper. Golf is not learned by playing matches, and of all the unenjoyable performances in the world, standing at a tee and driving one ball after another for a caddie to chase and bring back, swinging hour after hour in the hope of eliminating that exasperating slice, is about the most disheartening. Any modern game from beginning to end is *work*. Its value to the individual is not in the enjoyment or fun he gets out of every minute spent on it, but in the discipline, mental and physical and psychological.

My football experience began while the "flying wedge" was still the accepted method of putting the ball in play, and continued with few breaks until the first year of the forward pass. The bulk of it was done in the "guards back" and "tackles back" days. During this period my weight gradually increased from 110 pounds to a triumphant 135. Many and many a night during football season have I wept into my pillow from sheer discouragement and the pain of my bruises; many and many a day my knees have knocked together as I trotted out of the gym, thinking of the many times I was about to run in to take the place of my drawn-back tackle and in some desperate manner hold two men in their places till the half-back was clear, each man weighing from 50 to 80 pounds more than I. The pleasure I derived from it then was non-existent. But aside from the fact, brought out by Commander Taylor, that the rigid training of those eight years has left me under the necessity of careful exercise to avoid gout and muscle-binding, there is nothing in my entire school and college course which has been of so much use to me. I do not mean that the plaudits of the multitude ever paid me for my trouble, for if anybody ever called for a "long yell with three Mc's on it" I was too busy or too stunned to hear it. But in that grinding drill and hard punishment, I got a pretty fair grounding in the first necessity of success in any line—perseverance and subordination.

I agree heartily with Mr. Angell's stand against commercialism, but I do not agree with him in his belief that varsity teams and big games are

undesirable. They are the best that a college has to offer in the way of general training for making one's way in the world, and Commander Taylor's objection to overtraining is being slowly recognized and met by a system of college physicians whose business is to see that no boy is driven to the danger point.

"Big games" are good for the college and good for the boys. They must remain unless we want to go backward. The answer apparent to my mind is to have athletics endowed in the same manner as Greek or Biology, and an intercollegiate agreement on a maximum salary for coaches.

Mr. Angell repeats the fallacy of the "premium on weight as against dexterity." Weight has been and continues at a premium because of the absence of dexterity. There are many big men in the aristocracy of football, but they all got there by dexterity. But where is the big man whose game outshines that of Frank Hinkey (133 pounds), McBride of Yale (145), Johnny Hart (130), Arthur Poe (148), or Daly in his Harvard days? The University of Minnesota once put out a mammoth team, the "little man" of which—who is now Commander Hancock, S. C., by the way—weighed 185 pounds. Herschberger of Chicago and Pat O'dea of Michigan had no great difficulty in piloting lighter teams through them. Eckersall, Ristine, "Biscuit" Howard, Bullock, "Cracky" Dague—does anyone know any big men who could outshine them at any stage of the game?

It is to be regretted that more colleges have not followed the lead of Amherst and provided large fields for scrub games of all sorts, with room for five or six games going on at once. It is still more regrettable that more colleges do not follow the Naval Academy system of making each student pick at least one sport and go in for it to a prescribed minimum. But do not damn the big game. Without it, there would be no minor games with any educational value and very little to be gained physically which could not just as well be gained with the exciting dumbbells or the thrilling Indian clubs. The training in keeping one's temper, in merging one's entire strength into the team, in the suppression of self-seeking and loyality to the college—which is the beginning of loyalty to the firm or the navy or to America—the psychology of playing till you drop because the Idea needs you no matter how battered you are—all these depend on the big game. Not necessarily on making the varsity and playing in it, but in driving oneself to unsuspected limits in trying to make good enough to get there, and in heartily cheering your head off for the fellow who got your place away from you by superior playing.

Baseball players call it "heart"; bluejackets call it "guts," generals and admirals call it "morale," but we've got to have it; and very few boys ever wore padded moleskin without finding it. Nobody ever made a varsity team who did not have it. A game that does not call for considerable sacrifice of comfort or pleasure may build up a few muscles, but will do nothing towards making men.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Membership Life, regular and associate membership, 5683. New members: 9. Resignations: 16. Dropped: 4. Deaths: (4)

Rear Admiral T. C. McLean, U. S. N.
Captain G. W. S. Castle, U. S. N.
Captain J. Kearns, U. S. M. C.
Ensign H. O. Tovey, U. S. N.

Dues The annual dues ($2.50) for the year 1919 are now payable.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

Address of Members *All members are urged to keep the Secretary and Treasurer informed of the address to which* PROCEEDINGS *are to be sent, and thus insure their receipt.*

Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 15th of each month.

Book Department The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary

and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, 155 and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., SEPTEMBER 15, 1919.

INFORMATION INDEX

PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER WALLACE L. LIND, U. S. Navy

GENERAL ARRANGEMENT

FRANCE

REBUILDING FRANCE'S MERCHANT MARINE.—On August 5 the French Cabinet authorized M. L. Klotz, the Minister of Finance, to introduce a bill in the Chamber of Deputies granting 1,830,000,000 francs for the reconstruction of the French Merchant Marine.—*Scientific American*, 8/16.

THE FRENCH NAVY.—It is recognized in France, as in this country, that the present is a time of watchful waiting, in the phrase of President Wilson. With the German Navy gone, there is a wholly fresh outlook, and it would be foolish, to say the least, to resume at once the building of ships which would probably be out of date before completion. The Paris *Temps* laments the lack by France of a navy corresponding to her policy, and says: "It is necessary that in the present circumstances we should take note of our naval decline. Can we accept it and make no attempt to regain our former rank amongst the navies of the world?" There can be but one answer to this question, yet the voice of caution should not be disregarded in the eagerness of our Allies to raise the efficiency of their marine. What all the Allies have to do now is to determine how far and in what manner the events of war have influenced warship design. French naval construction has not always proceeded along the best lines. Sometimes it has been swayed by the idea of numbers of small craft, in the belief that the right policy was the *guerre de course;* at other times France has launched out into big ship programs which materialized slowly. To-day, she has 12 fine modern battleships, but they are outclassed by those completed for Great Britain during the war. Fortunately, France only lost one modern battleship, the *Danton*, during hostilities, whereas Great Britain lost two dreadnought battleships and three battle cruisers. We also lost eleven older battleships compared with three lost by France. No doubt the Ministry of Marine, in preparation for new ships which it may desire to build later, will overhaul its system of construction and the equipment of its yards and manufactories with a view to expediting output.—*Army and Navy Gazette*, 8/16.

A GREAT FRENCH SHIPBUILDING SCHEME.—A far-reaching scheme for the development of the French merchant marine in general, not only by the construction of a number of new vessels in the native shipyards, but also by the purchase of ships from Allied nations, has been prepared by the responsible Ministers, and a bill to authorize an expenditure of £78,000,000 for the purpose is on the point of being submitted to the legislative chambers for consideration. Apparently this proposed outlay, the approval of which is looked upon as a foregone conclusion, does not include the making of any provision either for incidental, though absolutely essential, projects, such as the extensions of port works and equipment for the rapid discharge of steamers up to 12,000 tons, or for the scarcely less important expansion of the sorting stations or sidings at the ports, in order to be able rapidly to deal with the great increase in traffic which it is confidently expected will be experienced in the course of the next few years. Prior to the war the total French tonnage of passenger and freight steamers combined represented 2,400,000. Of that total, 900,000 tons were lost during the course of hostilities. Even with the pre-war tonnage, however, it was only possible for one-fourth of the aggregate imports and exports to be shipped, the balance of three-fourths being transported in vessels belonging to other nations. The question of developing the merchant marine has been under consideration for some time past, and it has now been possible to prepare a scheme which M. Claveille, Minister of Public Works, states will result in the creation of a total fleet of 5,000,000 gross tons in a definite period of three years from the present time. Before deciding on the new scheme, an examination was made of the situation of affairs in the middle of July. It was found, for instance, that the gross tonnage of vessels acquired, constructed or ordered by the state on the basis of credits previously granted was 509,000. On the other hand, private shipowners have accomplished better results, better indeed than had been expected as a fresh beginning since the conclusion of hostilities, and an official tribute has been paid to the great efforts which they have put forth in this direction. Thus, the orders definitely placed by private enterprise in France and other countries comprise ships of a total of 1,015,000 tons gross, of which 491,000 tons represent passenger steamers and combined passenger and freight ships, and 524,000 tons consist of cargo vessels and other kinds. It will therefore be seen that the vessels ordered by the state and private shipowners reach a combined total of 1,524,000 tons.

It is, however, quite evident that an additional new tonnage of 1,524,000 is totally inadequate for a country which aspires to transport in national ships the whole of its outward and inward foreign trade, and even when supplemented by those of the pre-war fleet of merchant steamers which still remain, and many of which, be it said, should really be replaced by modern vessels, the number would be still insufficient if the national object is to be successfully achieved. Under these circumstances, the French authorities decided, in the first place, to take a census of the productive capacity of the native shipyards, for although it may be good policy to purchase ships from Allied countries, it is realized that it is better to keep the French yards and their workmen occupied. As a result of the census, the government proposes under the bill to allocate orders to the national yards for their entire production for a period of three years, "if the prices are reasonable." It is impossible to understand from recent speeches of the Minister of Public Works the amount of the tonnage which will be represented by these orders. But M. Clémentel, Minister of Commerce, was more precise on a recent occasion when he mentioned that the Minister of Public Works had already given orders to the national yards for vessels of a total of 1,000,000 gross tons. The Minister added that in these cases the prices to be paid by the builders for coal and ship plates had been guaranteed to be equal to English prices, so that the vessels would be constructed substantially at the same cost per ton for raw materials as British-built ships. It was explained that this concession would place upon

the shipowners the obligation to charge freight rates identical with those of British shipowners. As the prices for coal and shipbuilding materials have been guaranteed, the natural assumption is that, if the actual purchase prices are higher than those paid by British shipbuilders for the same kind of materials during the corresponding period, the amount of the difference will be defrayed by the government and the contribution will represent what is practically a subsidy on shipbuilding. On the other hand, and in the absence of any information on this particular point, it may be concluded that the ships ordered by private enterprise and representing 1,015,000 tons, or at least the percentage of them contracted for in native yards, do not carry a guarantee as to the prices which the builders will have to pay for coal and other materials.

It was, of course, known in government circles that the productive capacity of the French shipyards would be insufficient fully to cope with the program of 5,000,000 gross tons within a period of three years. As a consequence, the responsible Ministers some months ago approached the governments of the United States and Great Britain for assistance in the supply of ships. In this connection, the Minister of Commerce, replying recently to an interpellation on the economic policy of the government, stated that the 500,000 gross tons of ships arising from the agreement which he had signed with the British Government had now been allotted to the French. It is not quite clear whether these ships have been sold or transferred for a time, but an unofficial statement is to the effect that they have been lent. The Minister of Commerce also mentioned that important purchases were on the point of being concluded in the United States. Since then, M. A. Tardieu, General War Commissioner for Franco-American transactions, has given details of those acquisitions with which he has been associated. It appears from this information that the ships already delivered and those yet to be supplied by the United States will total 1,000,000 tons gross, of which 75 per cent will be steel steamers and only 25 per cent wooden vessels. In addition, there has to be taken into consideration the share of the German tonnage of merchant vessels to be assigned to France under the terms of the Treaty of Peace, so that the big program seems in a fair way of realization, at all events on paper. The French state under the circumstances promises to become a large merchant shipowner in the course of the next few years. No light on the problem of the working of the state steamers has apparently been thrown by recent Ministerial speeches, but the inference to be drawn from the speech delivered by the Minister of Commerce, as previously mentioned, is that the ships of 1,000,000 tons ordered by the state from private yards are to be transferred to shipping companies. Moreover, a French newspaper statement, which is attributed to an authority who is competent to judge the question, is to the effect that the steamers being built for state account are to be handed over to companies in which the state, so to speak, will become a shareholder for the amount of the state's contribution in ships to each company. If this really represents the proposed policy as regards the contemplated new fleet, considerably more than half the aggregate tonnage of 5,000,000 will be under government control. It remains to be seen whether this policy will prove to be sound. At any rate, without state intervention in the acquisition of ships, it would be impossible for the French nation to make the strenuous effort to become independent of the merchant fleets of other countries which is in contemplation.—*The Engineer*, 8/22.

GERMANY

GERMANY ADMITS FOUR MILLION TON SHIPPING LOSS.—While numerous figures have been published estimating Germany's mercantile shipping losses during the war, the first comparative statement of losses coming from Germany direct appeared recently in the *Berliner Tageszeitung*. This gives the following figures:

"As is well known, we owned on January 1, 1913, a fleet of 4850 ships of every size, with a gross register tonnage of 4,935,909 tons. We now have 3649 ships below 1000 tons, with a total of 589,263 gross register tons, and of ships above 1000 tons 106 ships with a total of 135,673 gross register tons. Altogether, therefore, Germany has 3755 ships with 724,936 gross register tons.

"The net result is a loss of more than 4,000,000 gross register tons, that is, more than four-fifths of our whole tonnage, which leaves us not quite enough to conduct our Baltic shipping with our own cargo space." —*Scientific American*, 8/16.

CONCLUSION OF THE BUILDING CONTRACTS FOR THE RECONSTRUCTION OF THE GERMAN MERCANTILE MARINE.—The negotiations between the Government, the ship-owning concerns, and shipbuilding yards with regard to the contracts for the reconstruction of the German mercantile marine have now been concluded, so that, looking at things from that point of view, there is now no impediment in the way of the constructions being energetically taken in hand in the yards at once. The basis upon which the costs of construction are being calculated is, briefly, the following: The shipbuilding yards are to build the ships under government control, and in so doing are to charge the factory (Selbstkosten) cost for the material and wages and to add to it so much per cent for working expenses, and then to reckon a percentage of profit upon the total amount. The following is the manner in which these costs are to be divided between the shipbuilding yards and the Realm. Taking the standard price for the gross registered tonnage as the basis, the prices for ships valid on August 1, 1914 and those valid on October 1, 1918, have been calculated. The Realm will assume the responsibility for the extra cost of ships as compared with October, 1918, whilst the difference between the prices obtaining on August 1, 1914 and those valid on October 1, 1918, will be borne by the ship-owning concerns and the Realm in equal proportions. For purposes of comparison it is interesting to note that the prices of October, 1918 amounted to about 2.8 times as much as the values of August 1, 1914, whereas the present value is 2.5 times as much as that obtaining on October 1, 1918—thus seven times as much as on August 1st, 1914. Therefore a ship that cost about 2,000,000 marks in 1914, could have been built for 5,600,000 marks in 1918, but now costs 14,000,000 marks. The contribution to be paid by the Realm therefore reaches a stately amount, but there is hope that it will be possible to reduce this burden for the taxpayer by means of a gradual reduction of the wages.

The settled situation resulting from the above agreements has resulted in an abundance of orders being given to the yards, but that gain is counterbalanced by the fact that the prospects for the delivery of shipbuilding steel are unfortunately practically hopeless. The orders given in December will probably be executed in August; at the present moment it is not possible to get orders accepted at all. Therefore in so far as the yards have not still some material at their disposal they will scarcely be able to complete any further constructions this year. This is all the more regrettable because in view of the present value of German money, orders from abroad could have been reckoned upon in spite of the enormous prices, as is proved by the negotiations between Scandinavian shipowning concerns and German yards, and that again would have been more advantageous, for technical reasons connected with the rate of exchange, than the exportation of unworked rolled steel which is now apparently necessary to pay for the foodstuffs imported.—*Hansa*, 5/3.

THE INTERNATIONALIZATION OF GERMAN RIVERS.—The peace terms proposed by the Entente demand the internationalization of all the large rivers which would still remain to Germany, in particular the internationalization, for the benefit of the Czechs, of the Elbe and the Oder. The Rhine has

been internationalized, in a way, for more than a century, and the system has given good results. There was an international Rhine Navigation Commission, which had to act as the supreme authority over the river and as court of appeal, and which regulated the development of the Rhine on a uniform system. Formerly England was represented on that commission in addition to the riparian states. In principle the flags of all nations were treated alike on the Rhine. Now, of course, endeavors are being made to give France the predominant influence on the Rhine, but it will scarcely be possible to make any change in the system of equal rights for all on the Rhine because Holland's influence upon and power over the Rhine navigation are too great. In the case of the Elbe a similar internationalization might well be agreed to, for the formation of which, by the way, the first steps had already been taken, should consist exclusively of representatives of the riparian states. On the other hand the Oder, being a purely German stream, cannot be taken into consideration straight away for internationalization. But we in Germany are in favor of a similar internationalization of the Vistula. But that is just the river for which the Entente does not provide internationalization, for the Vistula is to be placed under the sovereignty of the Entente state, Poland. And this brings us to the gist of the whole matter. All the German rivers are to be withdrawn from German sovereignty in order that the interests of all nations may be safeguarded. That is a sound principle, as in truth world-commerce and the freedom of trade and traffic must be considered first and foremost. But that would entail the internationalization of the Rhone, in order to secure to Switzerland an outlet to Marseilles; and it would be even more necessary to internationalize the Vistula and the Scheldt, and, above all, the Danube. But it has already been decided to leave the Vistula and the Scheldt out of the question. The Rhone is not mentioned at all in the peace terms, and difficulties are already arising with regard to the Danube. I see from a report in a Belgian paper that pettifogging little countries like Serbia and Roumania are opposing the internationalization of the Danube because they do not wish to abandon their own sovereign rights. Serbia and Roumania propose only that the League of Nations should be given supervisory mandate. Germany has, of course, no objection to a general internationalization of the great rivers, but it must unconditionally oppose the establishment of exceptional laws for the German rivers alone. Germany must demand that the same principles shall apply to all great rivers, thus, in particular to the Danube, Rhone, Scheldt, Po, Tagus, and the great rivers of Russia.—*Hansa*, 6/21.

GREAT BRITAIN

NEW BRITISH SHIPS.—The British Navy has long been the most powerful in the world, and the part it played for the Allies in holding the seas was a powerful factor in winning the war against Germany. When the war began, the British fleet displaced almost twice as much water as the German fleet, and this would have seemed sufficient to assure predominance. But the British Admiralty at once set on foot plans for additional ships, and the work of building was carried on with great secrecy but with remarkable efficiency and celerity. When the armistice put an end to hostilities 2,000,000 tons of warships had been added to the roster of the British fleet, and there were on the stocks, in addition, vessels aggregating almost another half million tons, including four mammoth battle cruisers, twenty-one light cruisers, over a hundred light cruisers, and eighty submarines. It was decided not to proceed with work on those of the ships that had only recently been begun, but, even with these omitted, it was found that the war and the ingenuity that it had elicited had found expression in a number of remarkable types of vessels, which in any new conflict would make the British Navy more powerful than ever.

The recent assemblage of Sir Roger Keyes's fleet at Southend, England, has enabled the British public to see some of the new types of ships built while the war was in progress. One of the developments of the war is what is known as the "Flying Squadron," consisting of four remarkable ships under the orders of Captain W. S. Nicholson. This officer's flagship is the *Furious*. This ship is officially described as a "light cruiser," but she displaces almost as much water as the battleship *Neptune*. She was designed as a fighting ship, with thin armor protection, a speed of thirty-two knots, and an armament of two 18-inch guns. Early in the spring of 1917 the fleet urgently needed fast airplane carriers, and it was therefore decided to adapt the *Furious* to this purpose, eliminating the heavy guns. A large hangar was built on the forecastle deck, and above this construction, which can accommodate about ten airplanes, a flying-off platform, 160 feet long, was made. The removal of the after 18-inch gun turret enabled a flying-on deck, no less than 300 feet long, to be provided. Of all the ships in the fleet, the *Furious*, with her strange erections, is probably the most notable. Though she is 786 feet long, as compared with 409 feet in the case of the original dreadnought, she draws only 21½ feet of water. The flying squadron includes three other seaplane-carrying ships—the *Argus*, *Vindex*, and *Vindictive*. The British Navy is the first to possess a squadron of this character to act as the eyes and ears of the heavy ships, performing, as there is reason to expect, scouting work more efficiently than it has ever been done by the fastest cruisers.

Remarkable progress was made during the war in the design and construction of under-water vessels. When hostilities opened, the submarine was a little vessel of slow speed, which usually crept about with a mother ship in attendance to render aid in case of accidents. The British fleet has now been provided with submarines which are submersible cruisers in all but name. The K-boats would have filled Jules Verne with delight. They are 338 feet long, with a beam of 26½ feet, and have a surface speed of no less than twenty-four knots—in other words, they can travel more swiftly than the cruiser *Powerful*, which twenty years ago was the swiftest vessel in the British fleet; while under water their electric motors drive them at nine knots. Each is armed with a 4-inch gun, besides a 3-inch anti-aircraft weapon, and possesses eight torpedo tubes. These submarines are of quite original design. Besides the steam turbine for going full speed on the surface and the electric drive for use when submerged, they are provided with a Diesel engine, which is employed just before diving or immediately after breaking the surface on rising after traveling under water, in order to shorten both these operations and enable the submarines to evade attack by more heavily armed surface craft.—*Mid-Week Pictorial*, 8/28.

HALTS WARSHIP PROGRAM.—All private shipbuilding yards throughout the country, numbering about twenty, are affected by the government order that all work be stopped on warships except those about to be launched.

The Admiralty yards at Chatham, Devonport, and Portsmouth will not stop, however, as they are entirely occupied with the refitting of 2700 steamers which are about to be returned to the owners, from whom they were requisitioned for war service. Among the warships being built at private yards are cruisers, destroyers, and submarines, and the work on some of these may be continued, according to *The Mail*, if it is found cheaper to complete them than to break them up.

Shipbuilders must be liberally compensated in cases where contracts are broken, but, although several million pounds sterling may be involved, it may prove more economical than carrying out the building program.

The Mail quotes an officer of the Admiralty as saying that one sound reason for stopping work on warships is that the step will clear the yards for commercial building. There is an excellent demand for new tonnage, and this work probably will absorb the men liberated by the stoppage of

work on naval vessels. According to *The Glasgow Daily Record*, work on forty warships, valued at £25,000,000, has been stopped.—*N. Y. Times*, 8/28.

RELATIVE NAVAL STRENGTH.—With the question of economy very much to the forefront of our national politics people are naturally curious to know what the prospects are of immediate reductions in our naval and military expenditure. So far as that on the sea services is concerned, the war has left legacies which it will take some months yet to discharge, and to judge by the daily press there is less impatience manifested with Admiralty administration in this connection, and rightly so than with that of some other departments.

Looking to the future, however, much must depend upon the standard of strength to be adopted by the government as that at which our naval forces must be maintained. For many years before 1909 our preparations were based upon a formula which had the great advantage of being simple and easily understood by the people. It was that the British Fleet should be equal to the fleets of the two next strongest naval powers. Only when Germany embarked on an extensive building program which was manifestly directed chiefly against this country did the two-power standard cease to be applicable, because it became inadequate. As Mr. Churchill admitted in the first speech he made on the Navy Estimates after his appointment to the Admiralty, "on the facts of to-day the navy we should require to secure us against the most probable adverse combination would not be very much greater than the navy we should require to secure us against the next strongest naval power," but he went on to explain why the time had come for us to readjust our standard in closer accord with actual facts and probable contingencies. "The actual standard of new construction," he said, "which the Admiralty has in fact followed during recent years has been to develop a 60 per cent superiority in vessels of the 'dreadnought' type over the German Navy on the basis of the existing Fleet Law." When the war came it was found that the Grand fleet in the North Sea was, in the principal types, less than 60 per cent superior to the High Sea fleet. It had 20 dreadnoughts against 13, and four battle-cruisers against three, but from 1915 onwards, with the reduction of our oversea commitments in modern armored ships, the relative strength of the fleet at Scapa gradually improved. At Jutland, Jellicoe took into action 28 dreadnought battleships against the enemy's 16, and Beatty had nine battle-cruisers against the German five, but there were also six pre-dreadnought battleships in the enemy fleet. In numbers, therefore, we were slightly over the 60 per cent margin, but not up to the higher standard of "two keels to one" which had been urged on the Admiralty from several quarters.

What the future measure of our strength is to be remains, no doubt, undecided for the present. It may serve to throw light on the situation, however, if a comparison is drawn between the numbers of ships in the principal classes in the British Navy to-day and the numbers in similar classes in the fleets of the two next strongest powers. Such a comparison may be made in perfect good faith and in no invidious spirit, since it happens that at the moment the powers concerned are our friends, the United States and Japan. The following table is based largely on the information contained in the new edition of Lord Brassey's *Naval Annual*:

	Great Britain	United States	Japan	U.S. & Japan
Battleships (dreadnoughts)	33	18	7	25
Battleships, building	—	6	2	8
Battle-cruisers	9	—	4	4
Battle-cruisers, building	1	6	—	6
Light cruisers	60	3	8	11
Light cruisers, building	12	10	—	10
Destroyers, built and building	390	326 ?	89 ?	415
Submarines, built and building	150 ?	122 ?	26 ?	148

From the above figures it will be seen that the British Navy's 33 dreadnought battleships exactly equal the total, built and building, of the two next strongest powers. The six building for the United States include the *Massachusetts*, of 43,200 tons, for which Mr. Daniels announced on August 1 that the contract had been placed with the Fore River Company. As regards battle-cruisers, Britain has nine, including two 15-inch, three 13.5-inch, and four 12-inch ships, as compared with the four *Kongos* in the Japanese fleet, which mount 14-inch guns. The six projected U. S. battle-cruisers were stopped in March last, until the results of Mr. Daniels' visit to Europe were known, so that if proceeded with they cannot be effective for some time yet. Meantime the *Hood* will be completed for our navy this year.

There is an overwhelming preponderance in British light cruisers. The 60 shown in the table excludes all launched before 1909—the *Scout* class, the *Gems*, and the *Boadiceas* with earlier types—and the building total of 12 is made up of four of the *Elizabethan* class and eight *D* cruisers. On the other hand, the 11 vessels in the American and Japanese navies are all that they have in the way of light cruisers. It is true that, looking backward for a moment, these powers have each 12 armored cruisers, including three for Japan, which mount four 12-inch guns, whereas the full total of British armored cruisers is 19. The armored cruisers belong to an obsolete type, however, useful in many ways, but totally unsuited to be put into the line of battle against more modern ships, as was proved not only by what happened to the squadrons of Cradock and Arbuthnot at Coronel and Jutland, but also, on the other hand, to that of von Spee at the Falklands. Destroyer totals are necessarily fluctuating at the present time, with several units of the war programs uncompleted, and a wholesale scrapping policy in progress. The British figures omit 97 vessels from classes *A* to *F*, but the maximum totals are given for the United States and Japan, although it is not known how many boats may be building for these powers, nor how many either is scrapping. It may safely be said, however, that the British destroyers certainly equal those of the other two nations in numbers, and are nowise inferior in power and battle-worthiness, having nearly all been built during the war. Roughly, too, it may be said that our submarines equal in number those of Japan and the United States combined. We began the war with 76 boats of all classes, and it is officially stated that our losses were 59. Those not lost, moreover, are scrapped by this time. During the war, however, Messrs. Vickers alone produced 54 British submarines, and it is known that at least two other firms, besides the public dockyards, were engaged in submarine construction. Even if the 148 boats of all classes in the United States and Japanese navies, from those launched in 1901 onwards, are taken into consideration, we have probably as many vessels, which on an average should be, of course, of greater size and power.

From this summary examination of the relative strength of the three navies, the fact emerges that we have certainly a two-power standard at present, and no very heroic measures are necessary to maintain it. To repair semi-obsolete ships must be absolute waste. In fact, unless some of the other members of the League of Nations decide to launch out into warship building programs, we ought to be able to effect large economies in material strength with complete safety and security, and also without resorting to expedients which would bear hardly on the personnel which has done so much in the war.—*The Army and Navy Gazette*, 8/23.

THE CHANGING POLICY OF GREAT BRITAIN.—In this country events rather than theory or calculation determine the national policy to a greater extent than in any other state. That is why its leading principles are seldom understood by the masses. Otherwise adverse criticism of the Budget would not have fastened on Imperial Preference as if it were a new factor, which was optional in our fiscal policy, but would have seen it in truer per-

spective as a symbol that Britain's position in the world has been changed by the war. She is no longer a creditor but a debtor nation, or, as Mr. Chamberlain put it, foreign exchanges which were once all in our favor are now partly in our favor and partly heavily against us. The money market of the world is, at any rate for the present, no longer in London, but in New York, and a more dangerous rival than even Germany is already contesting our supremacy at sea. The initiation of Imperial Preference, which was steadily resisted in this country for fifty years, is not a concession to the Dominions in recognition of their military aid during the war, but the first step in the commercial policy which is in process of being forced upon us by our changed circumstances.

Now as foreign affairs and armaments are intimately related, the modification in our economic policy is bound to be followed by a change in our military policy. Except indirectly, the politicians have, so far, failed to indicate its leading principles, the "no conscription" pledge at the last general election having had no reference to present realities. In the city Admiral Beatty emphasized the necessity for the maintenance of our sea-power, and Sir Douglas Haig for the creation of a Citizen Army, as the prophets did, in vain, before the war. But, in the circumstances, they could not indicate what the army and navy for which they call are in the future to guarantee. That is the duty of Ministers. It is, however, obvious that the principles which have guided successive governments since 1890 must be revised. They then appeared for the first time in a memorandum, which was not published until ten years later, and was drawn up by Mr. Stanhope, Minister of War in the second Salisbury Administration. This action was due to the demand of the Duke of Cambridge from the politicians for an intelligible military policy with a view to preparation for war. Although in the fifties the idea that free trade would end war was dominant, by 1869 the illusion was so far dispelled that the two-power standard for the navy was officially adopted by the government of that day. But the function of the army had become so indefinite that the War Office did not know what it was for, at any rate apart from policing the Empire.

In the Stanhope Memorandum it was laid down that, as Great Britain was never likely to be engaged in a European conflict, a small expeditionary force was all that she required, the underlying conception being that she was to remain a neutral state in perpetuity guaranteed by her navy. This marked her severance with the national policy in defence which had guided her for centuries, to correspond with her severance with the national policy in finance, commerce and shipping accomplished in the sixties. As the new departure bore no relation to the facts of international existence, the rise of foreign navies, especially one, forced us to recall our naval legions from the frontier, and later on to abandon the two-power standard. Hence our frantic efforts to secure our permanent neutrality (1) by "entangling alliances," (2) bartering our naval rights for "scraps of paper" at the Hague, (3) buying German "goodwill" by valuable concessions. As the war, which proved the impossibility of maintaining a cosmopolitan commercial policy with national armaments, drew nearer, the incoherencies of our military policy increased; for instance, the creation of the territorials on a voluntary basis, recognition that the expeditionary force might be employed on the continent, and the naval and military understandings with France and Belgium. Nevertheless, the fallacies underlying the Stanhope Memorandum were, practically, reaffirmed in its restatement as the Nicholson Memorandum of 1910, and the bankruptcy of our policy was completely revealed by the great war into which we were precipitated unprepared.

By her support of the League of Nations at the Peace Conference Britain attempted to provide the international basis for her trade and commerce which she failed to secure at the Hague Conference. But, up to the present, the results as regards armaments are negative, while the positive results are a more plentiful crop of ill-will as between states, together with nearer

prospect of numerous wars to come, than was ever produced under the old conception of things mundane. For this reason the doctrine of the balance of power has not been shelved, as Mr. Lloyd George and Mr. Wilson hoped, but is perpetuated in the conventions by which Great Britain and the United States undertake to go to the help of France should the German legions ever cross the Rhine again. But the danger of future conflict is now presenting itself, not in the West, but in the East.

Under these conditions the question of her military policy is for Britain a pressing one. The idea that she can preserve her neutrality in perpetuity has been shattered by the war and by the rise of the American Navy, which renders it doubtful that she can maintain her predominance at sea. Moreover, the progress of events since 1914 has convinced her that British finance and commerce cannot be cosmopolitan, and British industries national, without danger to her security. In spite of herself she has had to modify her fiscal policy during the war, and the armistice budget proves that the process is to be continued. It is, therefore, necessary for us to adopt a new conception of the function not only of the army but of the navy. Fortunately signs are promising that it is being worked out in the true British way, not by theory but by the pressure of events.

For long enough we defied as far as we dared the principle that "defence is better than opulence." Now that the price is paid in the passing of our opulence, we are retracing our steps. Cosmopolitanism is being abandoned wherever it impairs security, and so our fiscal policy is taking shape on national and, as the budget bears witness, on Imperial lines. To correspond with this development Lord Jellicoe is on a mission to the dominions in order that the naval defence of the Empire may be co-ordinated, not with a view to centralization but to decentralization. That the burden of maintaining British sea-power was growing too heavy for the people of these islands was plain before the war, it is plainer now. The dominions and India must contribute according to their power, and as they are willing to do. In no other way can the Empire survive in the new era of competition that is upon us. Hitherto the barrier to the full expression of this policy has been the lack of a common governing principle in Imperial trade. As Britain has now come into line with the dominions, the only sound foundation for an Imperial naval policy is being laid, and Canada, South Africa and India will follow the example set by Australasia in the creation of naval divisions of the navy as strong as their circumstances permit. The Five Nations, four of which are growing rapidly, and India between them ought in time to be able to maintain British sea power against all comers.

With regard to the army no definiteness in policy has yet appeared, and cannot as long as present conditions on the Rhine continue. An Imperial army we must have as we must have an Imperial navy. But we are further away from the recognition of a common principle for the foundation in the one than we are for the foundation in the other. For neither in Britain nor in Canada has universal service been adopted. All that we know for certain is that the old conception of the function of the expeditionary force is obsolete. We must devise a new military policy to correspond with our new economic policy, as we are already doing with regard to a new naval policy.—*Army and Navy Gazette*, 7/19.

NEW RATES OF PAY FOR BRITISH NAVAL OFFICERS.—America is in the habit of believing it pays for professional service the highest rates in the world. Perhaps this is true in the professional engagements of civil life. But in the National Service it is easy of proof that the United States is frugal indeed, and in comparison with Great Britain must take a seat far removed from eminence when the pay of navy officers is under scrutiny. Just at this time it is expedient to consider a few facts. We have before us an official table of rates of base pay in the British Navy which shows in the percentages of increase in post-war over pre-war pay in that service in

grades corresponding to those in the U. S. Navy, advances of from 185.7 per cent for midshipmen down to 31.9 per cent for junior lieutenants, or an average for the eleven grades of 79.3 per cent. The table follows:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rank (Line officers only)	Pre-war pay	Temporary raise for war	War pay temporary	Permanent raise over pre-war pay	Permanent post-war pay	Per cent. of raise of post-war over pre-war pay	Total allowances received in addition to post-war pay	Maximum permanent post-war pay [(5)+(7)]
Admiral of the Fleet	$10,643.40			$3,547.80	$14,191.20	33.3%	$11,973.83	$26,165.03
Admiral	8,869.50			3,547.80	12,417.30	40%	11,973.83	24,391.13
Vice Admiral	7,095.60			3,547.80	10,643.40	50%	11,973.83	22,617.23
Rear Admiral	5,321.70			3,547.80	8,869.50	66.6%	11,973.83	20,842.33
Captain (on promotion)	1,995.54	$2,085.33	$4,080.87	1,240.83	5,321.70	166%	1,054.35	6,376.05
Commander (on promotion)	1,951.29	2,039.99	3,991.28	1,790.91	3,742.20	92%	543.48	4,285.68
Lt.-Comdr. (on promotion)	1,153.04	1,414.46	2,567.50	1,021.81	2,174.85	88.6%	354.78	2,529.63
Lieutenant (on promotion)	975.65	1,153.04	2,128.69	532.17	1,507.82	54.5%	354.68	1,862.60
Sub-Lieutenant (on promotion)	665.21			212.02	877.23	31.9%	177.39	1,054.62
Midshipman	155.22	443.48	598.70	288.26	443.48	185.7%		443.48

—*Army and Navy Journal*, 9/13.

ROYAL AIR FORCE.—It has been decided that officer personnel of the Royal Air Force will be provided for the present: (1) By awarding a limited number of permanent commissions. (2) By granting 2500 temporary commissions.

The King has assumed the title of Chief of the Royal Air Force. His Majesty has approved of new titles for the commissioned ranks of the Royal Air Force. These are set out below with their corresponding ranks in the army and the navy:

Air Force	Navy	Army
Marshal of the Air	Admiral of the Fleet	Field Marshal
Air Chief-Marshal	Admiral	General
Air Marshal	Vice-Admiral	Lieut.-General
Air Vice-Marshal	Rear-Admiral	Major-General
Air Commodore	Commodore	Brig.-General
Group Captain	Captain	Colonel
Wing Commander	Commander	Lieut.-Colonel
Squadron Leader	Lieut.-Commander	Major
Flight Lieutenant	Lieutenant	Captain
Flying Officer (or Observer)	Sub-Lieutenant	Lieutenant
Pilot Officer	Midshipman	2d Lieutenant

The object which has been held in view is to preserve and emphasize the principle of the independence and integrity of the Royal Air Force as a separate service among the fighting services of the Crown.

The scheme is framed on the principle (*a*) that the ranks should as far as possible correspond to actual functions, (*b*) that the ranks should as

far as possible correspond to equivalent status in the three services, and (*c*) that there should be no repetitions in titles apart from the prefixes in the higher ranks. A distinction is preserved between the regimental officers and officers of general rank. Officers of general rank in the Royal Air Force are "Air Officers," and the expression "Air Officer" corresponds to the expression "General Officer" in the army or "Flag Officer" in the navy.

The new titles came into force on August 4.—*The Army and Navy Gazette*, 8/9.

THE BALTIC SUCCESS.—An important and dramatic success was achieved by the British naval forces in the Baltic against the Bolsheviks on Monday. The merit of the achievement is heightened because it was unparalleled by anything accomplished by our navy in the war with the Central Powers, whose vessels, kept almost entirely behind forts and minefields, gave no opportunity for such a feat. There may be some people who wonder why we should now be attacking the big ships of a power with whom we are not officially at war. But, as was explained in Parliament after the action of May 31, also in the Finland Gulf, the British Admiral opened fire on the Bolsheviks "because they opened fire on us." Those into whose hands the Russian ships had fallen were playing the part of pirates, pure and simple, and no peaceful traders or fishing craft were secure from their molestations. In such circumstances the British Navy was fulfilling its traditional rôle in an endeavor to restore order, and the brilliant operation of Monday should go far towards the attainment of this aim.—*The Army and Navy Gazette*, 8/23.

TO MAINTAIN BRITISH MERCANTILE SEA POWER.—After a very impartial and reasonable survey of the situation a well-informed correspondent of the *Observer* concludes that our position at sea is not lost, only threatened, and it will be our own fault if we do not make up our leeway. Whereas before the war we owned nearly one-half of the world's merchant shipping and America one-twentieth, now we own just over one-third and the United States just under one-fourth. Unless the leeway of over 5,000,000 tons of British shipping, which should be at sea and is not, can be made up speedily, the U-boats will have achieved one of their aims at least, that of displacing Britain as the chief maritime power. The consequences of such a defeat have perhaps been scarcely weighed by our countrymen. If we do not hold the mastery in our hands we shall be at the mercy of those who have it, and once dependent on foreign ships we should be almost as much a beleaguered citadel as in the deadliest days of the U-boat war. "We shall be," says the writer in the *Observer*, "defenceless before the operations of trusts of all kinds unless we retain the power to merchant our goods where we will and fetch what we require whence we please." By the needs of the Empire, no less than in justice to the memory of those who gave their lives to save us, the government must surely embrace the opportunity offered to make our mercantile marine more a truly national and Imperial service than it has been even in the most palmy days of our past.—*The Army and Navy Gazette*, 8/16.

JAPAN

AVIATION SCHOOL AT KURE NAVAL STATION.—The Japanese Navy will establish an aviation school at Kure at an estimated expenditure of yen 260,000. This amount will be added to next year's (1920) budget. Hiromura, Kamo district, Kure, was inspected yesterday by the future president of the school, Rear Admiral Yoshida.

An aeroplane machine shop has been built at Hiromura which is said to be the site of the future naval aviation field.—*Yorozo*, a Japanese newspaper, 7/15.

IE GREAT EXPANSION OF KURE ARSENAL.—Our Navy Department does expect to realize the scheme of 8:8 squadron organization at present, g to our government's united industrial resources. For this reason l authorities have made provision in the Budget for the purpose of exing our industrial resources on both the water and land. This is necesin order to accomplish the decided plan during the succeeding four s commencing during the year 1920. Also it has been decided not to any future warship construction orders to foreign countries. By ing properly our private factories in Japan orders from our navy will e the development of gun factories, and also the government factory at : Naval Arsenal, commencing during 1920. There are also plans on to manufacture armor and heavy gun forgings.—*Osaka Mainichi*, a nese newspaper, 7/8.

UNITED STATES

G SUBMARINE LAUNCHED.—The fleet submarine *AA-2*, the latest word ndersea boat construction in this country, was launched to-day.

ie *AA-2*, built at the Fore River yards of the Bethlehem Steel Corpori from the designs of the Electric Boat Company, is said to be the st Diesel-engined boat afloat. Her surface speed will exceed 18 knots our and she can run at 13 knots submerged, according to the designers. was designed to operate with the battle fleets and has a cruising radius nated at 7000 miles. The *AA-2* is approximately 300 feet long.—*N. Y. es*, 9/7.

INETEEN SHIPS BUILT IN ONE MONTH.—During the month of July, 1919, Bethlehem Shipbuilding Corporation established a world's record for deliveries by completing and delivering ten 35-knot torpedo-boat royers and two large submarines for the U. S. Navy, five large tank ners and two ocean-going tugs for the Emergency Fleet Corporation. he same months the 35 other American shipyards delivered only ressels, including destroyers and submarines. The largest number essels delivered during the same period by any other corporation was t ships, while from all the other yards building naval vessels, only e destroyers and one submarine were delivered. Since all the engines, rs and deck machinery required for these 19 vessels were built by Bethlehem Corporation, as well as the complete hulls, some idea of magnitude of this accomplishment can be gained, especially when it is zed that for the destroyers alone Curtis turbine engines totaling over larter of a million shaft horsepower were constructed, and also the row type water tube boilers necessary to generate this vast volume of m. To supply shipyards with the steady flow of material necessary for iccomplishment of such rapid construction was in itself a record, as over 0 tons of material were used, requiring over 1500 freight cars, which ld make a freight train over 18 miles long. If all of the 19 ships were nored end to end in the Hudson River, they would make a parade over mile long, or from 110th Street to 130th Street. The scientific conction of torpedo-boat destroyers has been so efficiently developed by Bethlehem Shipbuilding Corporation, that a destroyer has been comely built and delivered to the government in 174 working days from the ng of the keel. This same type of vessel took approximately one and alf years to build before the war.—*Army and Navy Journal*, 8/23.

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETI

AS REPORTED AUGUST 31, 1919

Type, number and name	Contractor	Per cent of complet			
		Sept. 1, 1919		Aug. 1,	
		Total	On ship	Total	
Battleships					
43 Tennessee	New York Navy Yard	85.2	80.7	82.1	[illegible]
44 California	Mare Island Navy Yard	72.2	64.2	68.4	[illegible]
45 Colorado	New York S. B. Co.	30.1	10.3	28.4	
46 Maryland	Newport News S. B. & D. D. Co.	53.	44.5	51.3	4
47 Washington	New York S. B. Co.	29.5	9.6	28.	6
48 West Virginia	Newport News S. B. & D. D. Co.	25.1	2.2	24.2	2
49 South Dakota	New York Navy Yard	0.	0.	0.	0.
50 Indiana	New York Navy Yard	0.	0.	0.	0.
51 Montana	Mare Island Navy Yard	0.	0.	0.	0.
52 North Carolina	Norfolk Navy Yard	0.	0.	0.	0.
53 Iowa	Newport News S. B. & D. D. Co.	0.	0.	0.	0.
54 Massachusetts	Fore River S. B. Co.	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Fore River S. B. Co.	Plans	being	revis	ed
2 Constellation	Newport News S. B. & D. D. Co.	Plans	being	revis	ed
3 Saratoga	New York S. B. Co.	Plans	being	revis	ed
4 Ranger	Newport News S. B. & D. D. Co.	Plans	being	revis	ed
5 Constitution	Phila. Navy Yard	Plans	being	revis	ed
6 United States	Phila. Navy Yard	Plans	being	revis	ed
Scout Cruisers					
4	Todd D. D. & Const. Co.	30.7	9.1	29.7	7.8
5	Todd D. D. & Const. Co.	28.2	7.1	27.3	6.
6	Todd D. D. & Const. Co.	23.3	1.6	22.1	1.3
7	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
8	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
9	Wm. Cramp & Sons Co.	15.	....	14.	...
10	Wm. Cramp & Sons Co.	15.	....	14.	...
11	Wm. Cramp & Sons Co.	4.	....	3.	...
12	Wm. Cramp & Sons Co.	4.	....	3.	...
13	Wm. Cramp & Sons Co.	4.	....	3.	...
Miscellaneous					
Fuel Ship No. 16, Brazos	Boston Navy Yard	98.6	98.5	98.5	9
Fuel Ship No. 17, Neches	Boston Navy Yard	30.	19.	26.	
Fuel Ship No. 18, Pecos	Boston Navy Yard	6.2	.2	.2	
Gunboat No. 21, Asheville	Charleston Navy Yard	94.7	89.7	90.5	
Gunboat No. 22, Asheville	Charleston Navy Yard	6.5	5.	5.	
Hospital Ship No. 1, Relief	Phila. Navy Yard	46.8	41.4	43.3	
Amm. Ship No. 1, Pyro	Puget Sound Navy Yard	95.	90.	93.	
Amm. Ship No. 2, Nitro	Puget Sound Navy Yard	63.	48.	57.	
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	0.	0.	0.	
Destroyer Tender No. 3, Dobbin	Phila. Navy Yard	0.	0.	0.	

There are 148 destroyers, 60 submarines, 7 mine sweepers, 18 se tugs, 16 harbor tugs, 12 oil tankers and 31 Ford eagles in various s completion.

There were completed and delivered to the Navy Department d month of August 6 destroyers, 2 submarines, 3 harbor tugs an eagles.

There are in addition 12 destroyers and 10 submarines auth not under construction or contract. Miscellaneous vessels auth not under construction or contract (3): 1 submarine tender N stroyer tender No. 4, and 1 transport No. 2.

NAVAL POLICY

THE ARGUMENT FOR THE SUBMARINE.—In our previous issue we presented the argument against the future construction of submarines, which is based mainly upon its frightful potentiality as a means of piracy against merchant shipping, and to a less extent upon its hitherto supposed tactical inefficiency when employed in legitimate operations against enemy warships.

Our suggestion that, because of the German misuse of it, the submarine should be outlawed has brought forth so many protests from naval officers, and, strange to say, particularly from those of the British service, that we have made a fresh study of the subject, based upon hitherto unrevealed facts of the war, and as a result we confess to a considerable modification of our attitude, particularly as to the military efficiency of the submarine.

Thus, an officer of our own service who has specialized in submarine work writes us: "I think you do a great injustice to the British submarine service, for they have done truly remarkable work. It may interest you to know that the losses in the British submarine service were relatively greater than the losses in any other branch of any service engaged in the World War. Some day the truth will be told and the British submarine will gain the crown it so justly deserves."

The efficiency (legitimate military efficiency) of the German submarines during the four years of war has been revealed by one of the Allied Service magazines, which states that they accounted for more warships than any other agency. Omitting the warships lost by being wrecked, by collisions, and by accidental explosions, submarines accounted for nearly one-third of the total losses, the mine coming next with one-fifth to its credit. Since the mines, after the first few months of the war, must have been laid by mine-laying submarines, the Allies having command of the surface of the sea, it is reasonable to credit the submarine with one-half of the Allied loss in warships.

So much for its tactical success. As to its strategical effects, they are so well known as to require no elaboration. One does not read very far in Jellicoe's book without realizing how greatly the submarine influenced, if indeed it did no dominate, the strategy of the North Sea and the great blockade. In the early days of the war the British seem to have attempted a close blockade of the enemy coasts; but the sinking of the *Cressy, Aboukir* and *Hogue* by a single submarine in a single attack changed the strategy overnight, and thenceforth the close blockade was abandoned. Later, it is true, the British submarine took over the work in a modified degree; but the attempt to shut the German fleets in their harbors by maintaining a superior force of surface ships off the German coasts was abandoned. Thereafter the lines of the British blockade were removed to the northern and southern exits from the North Sea, and the blockade lines were drawn from the Orkney Islands to Norway and from Dover to Calais. It is evident, then, that the work of the submarine service as now being revealed, has raised this type of fighting ship until it takes rank as one of the main elements in the make-up of a well-found fleet.

Naturally the abolition of the submarine would be to the great advantage of the power or powers which control the surface of the sea, or possess the largest merchant marine. Great Britain and the United States are the leading powers, both in the strength of their navies and size of their merchant fleets; so that it is very significant that the strongest arguments for retaining the submarine have come from these sources. These arguments are based, of course, upon its military value.

An admiral of our navy who spent the period of the war in Europe and was intimately associated with the naval operations, draws our attention to the demonstrated efficiency of the submarine as a scout, particularly as developed during the operations of the war. This type of vessel, he affirms, is the only one with which it is possible to establish a scouting line which cannot be chased away by more powerful vessels. "You hardly

realize how much this means until you have been engaged in a good many chart meneuvers, or aerial maneuvers on the sea, and seen your scouting line of relatively light cruisers ripped up and rendered ineffective by the battle-cruisers of the enemy." But no line of battle-cruisers, however strong, would serve to scatter or break through a screen of submarines; and if they should attempt to drive through, seeking information of the enemy forces, they would do so at the greatest peril of loss or serious disablement.

Talk to any officer of this special service and he will tell you that the submarine is the one vessel that can cut loose from its base and cruise for months upon the high seas in absolute independence. Hence it is the ideal vessel for observation and blockade. In speed it has gone up to 24 knots (as in the case of the British K-boats) and in size to 2500 tons. In the present state of the art it is possible, on a displacement of 1800 tons, to build a submarine of 18 to 20 knots maximum surface speed, that can stay at sea continuously for three months and cover 10,000 miles at cruising speed. The maximum speed submerged would be 12 to 13 knots for one to one and a half hours, and at 5 knots submerged the radius would be about 220 miles.

These then are the proved military capabilities of the submarine, as determined or suggested by the experiences of the late war, and in all fairness it must be admitted that as a military unit, it has come into its own. Had it not been for the German abuse of the weapon, its abolition would never have been suggested; but, as one party to the present controversy remarked: "What legitimate weapon of war did they not abuse?"

That the cause for abolishing the submarine on humanitarian grounds is strong cannot be gainsaid; but that the interdict could be carried out is doubtful, because of the vast system of oversight that would be required—to say nothing of the irritation resulting from the wholesale espionage that would be necessary.—*Scientific American*, 9/6.

ARMY AND NAVY AIR CO-ORDINATION.—The claim by advocates of a Department of Aeronautics scheme, that the Joint Army and Navy Board on Aeronautics is inefficient because it is without either authority or power to act on questions of co-ordination of Army and Navy Air Services, would appear to be refuted by the work of the board during the last two weeks. Meeting three times a week, this board has taken up practically every question that might be expected to arise concerning the functions and duties of the respective services. Moreover, every matter that has come under consideration by the board has found army officers and navy officers practically in agreement as to the proper solution of the problem involved. The questions discussed have involved production, training, and operation, covering the entire field of aeronautics. Among the results already attained are some which certain Senators and Representatives in the present Congress have said could not be attained without the creation of a separate Department of Aeronautics.

It has been practically agreed that under certain circumstances the army is to undertake the training of navy and marine corps fliers; and on the other hand, that the navy is to train army fliers when their training with naval flying craft is necessary or desirable. This would go a long way toward solving the present difficulty with regard to the spotting of Coast Artillery fire several miles from shore. The training of army observers in seaplanes would eliminate the dangers always present if they were to be sent out for this kind of work in land planes. Similarly, it would be possible under such an arrangement for the army to take over the training of marine corps aviators in their land work, which constitutes a good deal of their training. Problems of production have also been worked out successfully. It has been determined that whenever practicable the two services are to keep each other informed on all matters of production, and whenever the same types of equipment are to be purchased,

orders will be combined in a manner that will permit of taking advantage of the market. This solution is an answer to much of the criticism generally raised against continuing the separate air services in army, navy and marine corps.

Ample indication of the authority which the board has, and the weight of its recommendations and studies is given in the fact that the Secretaries of War and of the Navy have appointed the directors of the Army and Navy Air Services as members of the board and have given them instructions to consider every matter that might properly come up in the coordination of the two services. The interest which is taken in the working of the board by Secretary Baker and Secretary Daniels is apparent in the fact that a meeting of the Joint Army and Navy Board on Aeronautics was held in the office of the Secretary of War with the Secretary of the Navy present. At that meeting the precept for the board laid down by both secretaries was that there should be no duplication of effort in the two services. The army and navy officers of the board are now working along those lines, and with such blanket authority results are forthcoming which may, they declare, vindicate the present system of control of the combat air forces by the two great military branches in the army and the navy. The Crowell report of the aeronautical situation in the Allied countries, recommending unification of air control, has not been considered by the board, nor has any other concrete suggestion for the amalgamation of the services. Indications at Army Air Service headquarters, however, are that before the matter comes up for final decision by Congress action along this line may be taken.—*Army and Navy Journal*, 8/23.

NAVY OFFICERS MAY TRAIN IN FLYING.—The Navy Department has authorized officers to make flights in aircraft receiving instructions in flying when such flights do not interfere with their regular duties or with operations of an air station or aviation detachment. When an officer is considered sufficiently skilled to safely maneuver aircraft he may at the discretion of the commanding officer of an air station or aviation detachment be permitted to engage in solo flying. No extra compensation will be granted for such flight duty. It is thought such knowledge of aviation will increase an officer's usefulness to the naval service, and therefore any injury incurred while making such flights will be considered as in line of duty.—*Army and Navy Journal*, 8/30.

MATÉRIEL

$18,000,000 ASKED FOR SHIP REPAIRS.—With the approval of President Wilson, Acting Secretary of the Navy Roosevelt recently sent to Secretary Glass for transmission to Congress estimates for additional naval appropriations totalling $18,000,000 to "permit of expeditiously placing and maintaining in a proper state of repair all of the fighting ships of the fleet."—*The Naval Monthly*, September, 1919.

LIQUIDATION OF NAVY WAR CONTRACTS.—The Navy Department has been very much alive in the liquidation of war contracts, as shown by data compiled by the Bureau of Supplies and Accounts. Upon the signing of the armistice immediate steps were taken to effect the greatest saving possible in connection with purchases in their initial stages and contracts already in effect. It was possible to cancel or withhold awards of purchases in progress prior to actual signing of contracts therefor to the amount of $27,420,427. Of contracts already in effect it has been possible to cancel all or parts of 858 contracts amounting to a saving of $24,163,866 without any liability or cost to the navy on account of such cancellation. In no case has the navy paid anticipated or unearned profits, only such profit being allowed as has actually been earned on the proportionate part of the contract completed. In nearly all cases the adjustments offered by the navy have been acceptable to contractors, the attitude of whom in only asking

a fair and equitable settlement being particularly commendable. In a very few cases is it expected that resort to the courts will be had by tractors.—*Army and Navy Journal*, 6/9.

OFFICIAL OPENING OF NAVY DRY DOCK AT PEARL HARBOR TAKES PLA The official opening of the navy drydock at Pearl Harbor, near Hono Hawaii, late in August marked the successful completion of one of most difficult engineering projects ever undertaken by the United S Government. The immense dock represents a total investment of than $5,000,000 and has been under construction for ten years.

The dock is completed just in time to add a much needed facility for of the ships of the Pacific fleet. The first vessel to enter the dock probably be one of the dreadnoughts of Admiral Rodman's force, pos the *New Mexico*. The dock is 1001 feet in length, 32½ feet deep, 114 wide at the bottom and 138 feet wide at the top. It will dock the lar ship of war now afloat or contemplated.

After the sections of the dock had been finished and were being anch in their places in 1913 the water was pumped out, whereupon the bot of the dock was forced upward by pressure from the sides, and the e neers and workmen were forced to stand helplessly by and watch fruits of four years of labor and millions of dollars of money crushed shapeless mass of debris.

A new plan of construction on a much greater scale was then adop Concrete sections 60 feet long and the full width of the dock were one at a time and lowered to the bottom of the drydock, securely ancho it. Then the great structure was built. Early in March this year the was pumped out for the first time. The upward pressure of the bot had been overcome and the structure rose but three-sixteenths of an when perfectly dry.—*The Naval Monthly*, September, 1919.

OUR SUBMARINE WINS U-BOAT TEST.—Acting Secretary of the N Roosevelt made comparisons to-day between German and American marines.

"New and interesting light is thrown on the efficiency of the Ger submarines by recent tests conducted by officers in the Bureau of C struction and Repair," said Mr. Roosevelt's statement.

"An opportunity recently developed in this country which permitt direct comparison between a late design of German submarine and a design of American submarine. While details of the comparative cannot be given, sufficient information is available to destroy the m advertised superiority of the German submarine.

"As is well known, five German submarines of the latest design brought to the United States for use in the Victory Loan campaign. of these boats came over under their own power, manned by officers men of the United States Navy. The propulsive machinery of the was partly destroyed or removed, so that it was necessary to tow this ve across.

"The best of these vessels was 'tuned' for special trials. When repo ready for these trials, a special Trial Board was designated to con the trials, following the established practice in carrying out contract t for submarines for the United States Navy. The boats compared were German submarine *U-111*, built at the Germania Yard, Kiel, Germ (completed in 1918), and *S-3*, a submarine designed by the Navy Dep ment; *S-3* was built at the Portsmouth Navy Yard and was commissio in 1918.

"These boats both belong to the '800-ton class'—*U-111* having a sur displacement of 830 tons and *S-3* a surface displacement of 854 tons.

DIMENSIONS

	U-111	S-3
Length	235 feet	231 feet
Beam	21 feet	21.5 feet
Draft	12.5 feet	12.5 feet

"In the trials the maximum surface speed of the *U-111* was 13.8 knots, while the *S-3* made 14.7 knots. The submerged speed of *U-111* was 7.8 knots, while *S-3* made 12.4—a remarkable difference in favor of *S-3*. The radius of action of the two boats is also in favor of *S-3*, despite all the furore that was created by the advent of the U-boats on the American coast during the war.

"*U-111* can cruise 8500 miles at 8 knots, while *S-3* can cover 10,000 miles at 11 knots. The submerged cruising radius shows an equal preponderance in favor of *S-3*. Both boats can carry twelve torpedoes. *U-111* mounts two 4-inch guns, one forward and one aft, while *S-3* mounts one 4-inch forward, this practice of one gun on a submarine being standard practice in the United States Navy.

"So much for the ordinary military characteristics of the vessels. It is necessary really to live in these vessels to appreciate the radical difference in their habitability, a vital military characteristic, for a submarine is no better than its crew.

"*U-111* is congested to the last degree; she is complicated in the extreme by the installation of many 'gadgets,' some of which are of doubtful utility and more doubtful necessity. Accessibility to her equipment is very difficult; frequently it is necessary to take down three installations to overhaul one.

"On the contrary, *S-3* is a habitable, livable proposition, comparatively 'roomy,' with reasonable accommodation for officers and crew. Her equipment is accessible and her general habitability is vastly superior to *U-111*.

"Much has been written of the seaworthiness of the German submarine. An opportunity to compare the seagoing capabilities of the two vessels occurred during these trials, and the general consensus of opinion among the officers conducting the test is that *S-3* is the more seaworthy vessel. Her decks are drier, her bridge less subject to green seas, and her general behavior in a seaway superior. Referring to the comparative diving capabilities of the two vessels and general handling, there are few differences, and these few appear to favor the *S-3*.

"In the reports of the outcome of the comparative tests, the Bureau of Officers points out that there should be no idea that 'we have nothing to learn from the Germans.' There are a number of interesting details in design, construction, and operation that are well worth while studying. A few features are worthy of adoption, for the *U-111* is the 'mittel U-boat,' which type is considered by the Germans as by far their best submarine."—*N. Y. Times*, 9/7.

PERSONNEL

MR. ROOSEVELT ASKS RELIEF FOR NAVY.—Acting Secretary of the Navy Roosevelt on Sept. 10 sent identical letters to Chairman Butler and Chairman Page of the House and Senate Committees on Naval Affairs, requesting relief for the officers and men of the U. S. Navy. Mr. Roosevelt does not go so far as to suggest the form such legislation should take, but urgently requests consideration of the necessities in the present situation. Mr. Roosevelt has been closely studying the question of navy pay and the conclusions he reached are expressed in the letter mentioned above, which reads:

"As you know, the question of increased pay for the officers and men of the navy has been of serious importance for some time. Two facts are, I think, indisputable. The first is that as compared with citizens carrying on work of a similar character in private life, *i. e.*, work which requires a simi-

lar amount of training, education and performance of duty, the civilians receive far higher salaries than the officers and men of the naval service. The second is that the existing cost of living has made it not only a hardship but well nigh an impossibility for the great majority of these men to remain in the naval service.

"The present pay of the navy really goes back to 1899, though a hardly noticeable increase was made in a few cases in 1908. I do not, however, believe that new legislation should be passed giving increases which would be based on the increase in the cost of living during the past few years. I think that all of us hope and believe that the present cost of living will be materially reduced in the near future. Nevertheless, some action is required. I think that few of us hope for a reduction in the cost of living to the figures of, let us say, 1914, quite aside from the reduction to the figures of 1908 or of 1899. The fact is perfectly clear that we face an existing situation and that we ought to do something to remedy it at the earliest possible moment.

"The case of the officers and men of the navy is not to be compared with the case of other government employees who have had increases, small or large, since 1914. The navy has not had increases at all unless one excepts the war pay of the enlisted men, which was increased from $15 to $30 a month. That increase, while it may be considered from one point of view as an increase of 100 per cent is because of the smallness of the original pay almost negligible. In the case of the officers no increase whatsoever has been made, and it is a well-known fact in every navy yard that dozens of first-class mechanics have been getting more pay than the officers in charge of the shops.

"Instead of presenting a definite bill to the naval committees of Congress, I believe that time and effort would be saved if the Committee on Naval Affairs of the House and Senate could appoint a sub-committee to investigate the subject in close co-operation with a committee representing the officers and men of the navy. Furthermore, it seems obvious that any measure giving an increase of pay to one service would be of interest to the other service also, and I think that in all fairness there should be close co-operation with the army and with the Committee on Military Affairs. I am putting this forward merely as a suggestion which may appeal to you, and if you prefer some other method I shall be only too glad to help. It may seem best to Congress to pass legislation in the nature of a temporary relief, but whether the legislation takes that form or is of a more permanent character I should like to make the point that I believe something should be done at as early a date as possible. I know your sympathetic interest in this subject, and I can assure you I will be glad to co-operate in every way possible."—*Army and Navy Journal*, 9/13.

AID TO MIDSHIPMEN PROPOSED.—There is a movement on foot to request Congress to consider extending the principle of the allowance which is made to men enlisting in the U. S. Navy to the midshipmen entering the U. S. Naval Academy. Enlisted men receive an allowance of $100 for clothing and equipment, but candidates who pass the examination for the Naval Academy are required to deposit $290 for clothing and $60 for books, a total of $350. The amount is not refunded, but is expended for clothing and text-books, which become the property of the midshipmen. Listed in "clothing" are such incidentals as blankets, bed sheets, bath towels, wash basin and pitcher, pillow cases, bed spreads, spatter cloths, hair pillow, hair mattress, waste basket, etc. There has grown up a feeling that the Naval Academy equipment should supply these furnishings to the midshipmen, for the reason that as a midshipman leaves the Academy at graduation, or before because of failure, he is hard put to dispose of furnishings except at great loss from original cost. It is also believed that the academy in these days of modern plumbing should not require the use of the obsolete

wash basin and pitcher and waste jar. A recommendation to the Navy Department for funds to make these desirable changes has not been approved, but in its stead it is proposed that a bill be sent to Congress providing an allowance of $200 to midshipmen on entering the Academy. Under the stress of living costs and conditions at this time it is considered a genuine hardship for parents of poor boys who enter the Academy to be compelled to supply $350 in cash, for the rule specifies that this entrance deposit "must be made before a candidate can be received into the Academy." Permanent fixtures and furnishings, it is believed, should be supplied by the government at the Academy.—*Army and Navy Journal*, 9/6.

INSURANCE MAY BE PAID IN LUMP SUM.—Payment of soldiers' and sailors' insurance to beneficiaries in lump sums instead of installments, when desired, has been recommended to Congress by R. G. Cholmeley-Jones, director of the bureau of war risk insurance. This, with several other changes, has been recommended with a view to making government insurance more desirable, so that all ex-service men will retain it after returning to civil life.

Under the present law insurance is paid only in installments extending over a period of 20 years. There is a strong congressional sentiment against this proposed change. It is also recommended that the list of beneficiaries, which now may include only near relatives, be extended to include aunts, uncles, nieces and nephews when desired.—*The Naval Monthly*, Sept., 1919.

300 OFFICERS SUBMIT RESIGNATIONS. —With the resignations of more than 300 permanent officers of the regular navy already submitted to the department and more arriving daily, Acting Secretary of the Navy Roosevelt has begun work on proposed legislation to be submitted to Congress suggesting substantial pay increases for officers and enlisted men of the navy and marine corps.

High-ranking officers believe the efficiency of the navy is seriously threatened. Most of the resignations have come from the younger officers in the lower grades. These officers, receiving from $1700 to $3000 a year, most of them Annapolis graduates capable of earning much higher salaries in civilian life, say they find it impossible to support their families on their pay.

More resignations are now on file than had been received from the entire regular navy in the last 30 years. Since 1898 the average has been seven a year.—*The Naval Monthly*, Sept., 1919.

OPERATIONS

THE ATLANTIC FLEET AND THE PANAMA CANAL.—Among the various considerations that led the United States Government to build the Panama Canal, the most urgent, undoubtedly, was the desire to bring the Atlantic and Pacific seaboards into close relationship. The new bond that was to be thus established would be two-fold—commercial and military. Of the commercial advantages nothing need be said—they have been manifold from the day on which the first merchant ship passed the canal.

The military advantages of the great waterway are many, and in no direction are they so immediate and invaluable as in the added efficiency and mobility which has been conferred on the United States Navy. Before the canal was cut any warship or fleet of warships that was called upon to pass from the Atlantic to the Pacific, or *vice versa*, was confronted with a 14,000 mile trip. Most of us recall the ever-famous run of the battleship *Oregon* from San Francisco, where she was built, to join Admiral Sampson's fleet in the West Indies. Nor shall we ever forget the anxiety with which her progress down the Pacific and up the Atlantic coast was watched by the nation.

There is no doubt that the strategical situation during the Spanish war proved to be a powerful incentive to the purchase of the French rights at the Isthmus of Panama and the completion by the United States of the great waterway. From the day on which it was opened, it became possible adequately to protect our coasts on either ocean; whereas, so long as the only route from the Atlantic to the Pacific involved a journey of 14,000 miles, it was necessary to maintain the bulk of our fleet where the bulk of our wealth lay, namely on the Atlantic Seaboard. It had always been a matter of concern to the Navy Department that the Pacific coast and its great seaports were so far removed geographically, from the bulk of our fighting fleet that it could receive no immediate assistance in case of attack.

The cutting of the canal has changed all that; and the rapid growth of our fleet, due to the war, now makes it possible to maintain two powerful battleship fleets, one on the Atlantic, the other on the Pacific, under such conditions that the whole fighting strength of the navy can be concentrated in either ocean within two or three weeks' time.—*Scientific American*, 8/30.

THE AMERICAN NAVY'S ACHIEVEMENT.—When hostilities ceased the United States Navy had permanently based in European waters 373 vessels, including eight battleships, 70 destroyers, 120 submarine-chasers, 12 submarines, and over 50 seagoing patrol vessels of various types. There were also 81,000 officers and men serving in Europe, or 15 per cent of the total American naval personnel. The significance of these figures, taken from an article by Mr. F. D. Roosevelt, Assistant Secretary of the U. S. Navy, in the American number of the London *Times*, will be apparent to all who are acquainted with our naval progress. The personnel must equal that of all our seagoing fleets before the war. The destroyers were more numerous than those under Jellicoe's command in the Grand fleet up to the spring of 1916. Thus the material contribution of America in 19 months was remarkable. It would have been still more remarkable but for the sudden termination of hostilities. About the splendid spirit of co-operation shown between the two navies Mr. Roosevelt affirms that, while never doubting for a moment that it would exist when America was able to take her part in the war, a remarkable discovery was made on the day the first U. S. destroyers reported to Admiral Sir Lewis Bayly at Queenstown. This was that the British and American naval forces had been trained along almost identical lines, that the types of ships fitted in well together, and that only slight changes were necessary to make one homogeneous naval force. As Admiral Mayo has truly said, England and America are, and will continue to be, the greater and better friends for the experience that has come out of the cordial co-operation and co-ordination required by the common interest in this war.—*The Army and Navy Gazette*, 7/19.

MERCHANT MARINE

CREWS OF U. S. MERCHANT SHIPS.—The proportion of native-born and naturalized Americans among the officers and crews of American merchant ships during the fiscal year ended June 30, 1919, increased to 47.6 per cent of the total and is now substantially the same as in 1914, but native-born Americans comprised four-fifths of this percentage for the past fiscal year and two thirds during 1914. The change is due in part to young Americans discharged from the navy who have entered the merchant service, to those who under the draft laws preferred the merchant service to the army, and to the appropriation of $6,250,000 by Congress to the Shipping Board for recruiting and training officers, engineers, and crews for American merchant vessels.

The nationality of those shipped as officers (excluding masters) and men (counting repeated shipments) before United States Shipping Commis-

sioners, as returned to the Bureau of Navigation, Department of Commerce, was as follows for 1914 and 1919:

Nationality	1914	1919
Americans (born)	63,247	97,160
Americans (naturalized)	31,417	24,676
British	24,745	26,848
Chinese	64	729
Japanese	98	1,198
Filipinos	472	1,154
Germans	9,497	138
Norwegians	8,194	10,237
Swedes	6,321	10,054
Danes	2,260	5,843
Russians	4,526	10,108
Austrians	3,363	125
French	617	694
Spanish	25,022	24,163
Italians	4,368	2,503
Portuguese	3,921	5,481
Others	11,442	34,811
Unknown	10	

Those classed as "others" are mainly from the countries of South America, citizens of the several states which have been created by the war, and Swiss shipping as stewards.—*U. S. Bulletin*, 9/8.

MERCHANT MARINE PROGRESS.—Coming so quickly from a position at the rear to take rank as one of the first of nations in point of merchant marine, the United States has outstripped in performance the knowledge of most of its citizens. Every one knows we have a Shipping Board and every one has heard that we built ships and then more ships, built them fast and built them faster, and that the results of our labors were the difference between starvation and keeping alive, as far as Europe was concerned.

But few know how this great fleet has been turned to peace-time uses. Not that there is any secret about it, but merely because publicity has not been able to keep up with performance.

Yet the amazing facts are there. We have now eight hundred and twenty-nine ships, government or government owned, aggregating four million two hundred and forty-eight thousand nine hundred and seventy-three dead-weight tons, at the present moment actually engaged in general commerce. This does not include more than 50 per cent as many more dead-weight tons still in use by the army and navy or for overseas civilian food relief. Nor does it include ships owned by private companies and so operated. These ships are the property of the United States, which has put them into service in general and specific cargo work to such good effect that there is a United States vessel carrying United States goods on regular schedule to every important port of entry in the entire world.

A rather different situation to that before the war, when practically all goods shipped from the United States to foreign countries traveled in foreign bottoms.

These ships are giving general cargo service on sixty-two regular lines, following trade routes which have been opened during the last six months. And we are promised that this is but the first step which will convert ocean tonnage, released from war labors, to those peace-time services which will put this nation back where it of right should be—in the forefront among the maritime nations of the world.

There is no reason and less excuse for any shipper in the nation to employ a foreign bottom to carry his goods. No matter where he wants to have them carried, a United States bottom will carry them there. Nor need he say that he must use a foreign bottom because of any particular

port in this country being more convenient to his factory or mine or ranch. Our own boats now sail from many of our own ports, so that we serve ourselves not only with our own vessels, but in the most convenient manner with those vessels.

Note that the sixty-two lines thus established are regularly sailing on schedule, announced in advance. The great advantages of this must be apparent even to the non-shipper. If a man has a cargo or half a cargo of tin cans or pianos, going to anywhere, any country, and happens to strike a tramp ship also going there at the same time he wishes to ship, he can use it and care nothing for an announced sailing. But such coincidences are rare. Most shippers want to know in advance when they may ship, from where they must ship, and what the freight rate will be. The establishment of a regular cargo-carrying service serves the shippers thus, exactly as a regular train service from point to point serves his convenience when he would travel himself. Scheduling departures and approximate arrivals allows the shipper to sell abroad for future delivery with the reasonable assurance of being able to make such delivery within a specified time.

The established trade routes cover the whole world. Thus there are forty-seven steamers sailing to the Argentine and they sail from New York, Boston, Mobile, New Orleans, Wilmington, Charleston, Savannah, Brunswick and Jacksonville. Two steamers go from New York to Pernambuco, Maceio and Bahia, North Brazil. Twenty-five sail to mid-Brazil (Rio and Santos), from New York, New Orleans, Wilmington, Charleston, Savannah, Brunswick and Jacksonville. Five steamers from New York and one from New Orleans make regular trips to the west coast of South America, ranging from Guayaquil, Ecuador, to Valparaiso, Chile. Two steamers go from New York to North Africa and Egypt; five from New York to the Dutch East Indies; two from New York to Bombay and other Indian ports; three from New York to Spain (Barcelona, Valencia, Cadiz, and Seville). Every two months a steamer goes from the metropolis to Danzig, and every six weeks one or two steamers sail out the Narrows to Constantinople and the Black Sea ports. Three steamers sail from New York to West Africa, two to South Africa, three to Australia and New Zealand, and three to China, Japan and the Philippines. Fifteen steamers leave the Golden Gate, one every ten days, for China and Japan, and two more from the same port go to Europe via the Far East.

We have a steamer from New York to Genoa, and one from Baltimore to the same port; while two serve Grecian ports from New York. To London we send six steamers from New York, three from Philadelphia, two from Baltimore and one from Norfolk. We send six to Liverpool from New York, two from Boston, five from Philadelphia, one from Baltimore, one from Norfolk and one from Galveston. New York says good-by to three ships clearing for Glasgow on monthly sailings, four to le Havre, and three to Bordeaux. The latter port is also served from Boston and Baltimore with two and one steamers respectively. New York sends two steamers to Marseilles and seven to Antwerp, while two from Boston, and one each from Philadelphia and Baltimore go to the same destination. Rotterdam sees New York ships to the number of ten and from Philadelphia, two. Copenhagen and Gothenburg are served by five steamers from New York while the West Indian ports are visited regularly by two steamers from Wilmington, two from Charleston, two from Savannah, two from Brunswick and two from Jacksonville.

Meanwhile, the balance of the list of ships is engaged in going to every port of the world where a cargo can go—and the flag at the stern is the stars and stripes.

It would be pleasant if it could be chronicled just what the future will hold for these ships, and the trade lines thus established. But to state this would require a prophetic vision of what the Congress is going to do. At the present time the ships are the property of the United States and by it

given over to private organizations, shipping combinations, individuals, firms, partnerships, etc., under certain terms. The United States gets paid for the use of its ships; they are emphatically not, as some soap-box orators have stated, built by taxes and given to the wealthy to operate for nothing.

When a firm has satisfied the Shipping Board that it is financially responsible, experienced in business, and that it has the confidence of other business men, it is able to make a contract with the United States, through the United States Shipping Board Emergency Fleet Corporation, for the use of one or more ships. This contract is a new document in shipping annals, for never before has the United States engaged in shipping as a sort of half-partner in the firm. It provides that the Emergency Fleet Corporation "will man, equip, victual and supply the vessel, and provide and pay for all provisions, wages, and consular, shipping and discharge fees of the master, officers and crew and all cabin, deck, engine-room and other necessary stores and will exercise due diligence to maintain the vessel in a thoroughly efficient state, in hull, machinery, tackle, apparel, furniture and equipment for and during service."

On the other hand, the operator as agent for the Corporation must operate as the Corporation directs as to voyages, cargoes, priority of cargoes, charters, freight rates, etc. The operator provides and pays for fuel, fresh water, stevedoring, port charges, pilotages, agencies, commissions and consular charges except as specified, and all such expenses as usually are borne by the time-charterer of a vessel. It is the business of the operator to collect the freight charges and in such a manner as will insure to the Corporation its revenue from such freight charges.

For his labors and his capital invested the operator receives his pay in the form of commissions. Thus, on all vessels except oil tankers he receives a commission on general cargo of 2½ per cent on the gross ocean-freight list. On bulk cargo he gets half as much, the term bulk cargo meaning one of which 50 per cent or more is loaded at and discharged at one port and covered by one bill of lading; also all United States Government cargoes when the vessel is exclusively so laden. The operator gets a port fee of $250 when coming into United States ports from foreign or dependency ports and a 5 per cent commission on all mail, express and commercial passenger revenue.

In a few words and short, the United States owns and "finds" the ship, the operator runs it, the United States gets the freight and pays the operator a commission on that freight.

So far, this dual system has worked out as well with the United States as owner as it would with a private owner time-chartering the vessel to an operator. The speculative feature is pretty well eliminated from shipping operations, but at the same time, the risk of chartering a vessel of uncertain or weak ownership is also eliminated. If the operator is unable to take advantage of the fact that he may charge what freight rates the traffic will bear, and must charge what the Corporation says, he is also protected against an unseaworthy ship, against trouble with pay of officers and crew, against objections to food or findings. And he has the greatest country in the world behind him, and the knowledge that though he, as agent, is the responsible head of the voyage, he has also all the power of the country back of him in any port he may enter, for this is not a privately owned but a government owned boat.

The freight rates established by the Shipping Board are published and anyone can obtain them at any time. Anyone may learn at any time just when a ship is to sail for any port, the probable time of her arrival, what space is available for his cargo, what it will cost to carry it. The United States is seeing that its ships are run more like a railroad schedule than anything else, and while of course breakdowns at sea and the unforeseen in storm or accident may prevent a vessel from keeping to schedule, the

probabilities are much in favor of a ship sailing when it is scheduled to sail and arriving when it is scheduled to arrive.

It is the general consensus of opinion that this good start will remain a good start only if it have a different finish. It has been recommended to Congress that the ships be turned over to private enterprise by sale, according to certain carefully worked out plans, so that within a short period of years all this floating property shall belong to shipping lines rather than to the government. Just what disposition Congress will make of this recommendation, just how long it will continue what is in effect, if not in fact, a ship subsidy to operators, no man knoweth. But this much is certain. The government has demonstrated (1) that there is use and plenty of it for a great fleet of merchant marine flying our flag from our ports; (2) that it is perfectly possible to make money by operating these ships at fair freight charges, under existing laws; and (3) that there is no fundamental reason why this country cannot keep what it has gained in getting, through the war, a great fleet of cargo carriers. It is for intelligent action of the future to see that we do keep it.—*Scientific American*, 9/6.

NAVIGATION AND RADIO

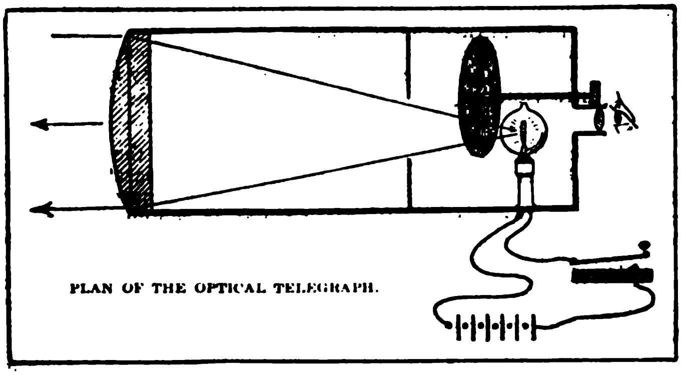
NAVY TO AID VESSELS ON GREAT LAKES.—Instructions were given by the Navy Department on August 22 for the inauguration of a Great Lakes patrol to assist vessels navigating those waters. The project embraces the detailing of a large vessel to operations on each of the lakes, though only four could be detailed at this time of the shortage of suitable craft. Eventually, should the coast guard be retained permanently in the navy, new mine sweepers will compose the Great Lakes patrol. On account of the engagement of the sweepers in removing the North Sea mine barrage, only two sweepers can be spared for the lakes this fall. The orders issued on August 22 detail the mine sweepers *Owl* and *Pigeon*. Assisting them will be the sea-going tug *Tadousac* and the coast-guard cutter *Morrill*, and all will be in charge of officers thoroughly trained in coast patrol work. It is expected that the patrol will be in operation about September 15 and will continue until navigation closes. Coincident with the patrol of the lakes to aid vessels in distress and to save life and property, the ships will assist the Department of Commerce in the enforcement of the navigation and motor-boat laws.—*Army and Navy Journal*, 9/6.

THE GYRO-COMPASS IN MERCHANT SHIPS.—The Sperry Gyro-Compass, which was employed with highly satisfactory results in many Allied surface and submarine war vessels during the hostilities, is now, as was confidently expected, making headway in the world's mercantile marines. The new compass has been installed in the Cunard liner *Aquitania*, and among the orders in hand are one for the White Star liner *Ceramic*, one for the Canadian Pacific liner *Empress of France*, one for the Den Norske Amerika-line's vessel *Bergensfjord*, one for the "Lloyd Sabaudo" liner *Re d'Italia*, and one for the liner *Lutetia*, owned by the Compagnie de Navigation Sud-Atlantique. The *Aquitania* has completed a round trip to New York since her Sperry Gyro-Compass has been installed, and the results have been highly satisfactory. The master and his officers are enthusiastic about its work, and state that their expectations have been more than realized. The *Ceramic's* gyro-compass is to be installed before the vessel leaves on her next voyage to Australia.—*Shipping*, 8/23.

INVISIBLE SIGNALS.—Signals that can be rendered visible to those who are to receive them, while remaining invisible to all else, have undoubted advantages from the standpoint of secrecy which would make them valuable in military operations. Such signals were used in the recent war, owing to the inventive skill of an American, Prof. R. W. Wood, of Johns Hopkins University, whose work with invisible rays, especially in pho-

tography, has been noted from time to time in these columns. Professor Wood's plan is to use a source of invisible rays, either those below or above the visible spectrum, and to employ a receiving instrument that makes them visible again. No one not provided with the proper receiver could have any idea that signals of any kind were passing. We translate, inpart an account of Professor Wood's apparatus, contributed to *La Nature* (Paris, May 31), by H. Vigneron. Writes this author:

"First Professor Wood perfected the classic devices of optical telegraphy. In one of the systems in service in the German Army the signals are made by an electric lamp placed inside a tube which enables the sender to direct the light-beam as he chooses. Field-glasses fitted with this system enable a soldier to observe the signals sent in reply. The batteries supplying the lamp are placed in the belt shown in the illustration. All the apparatus of optical telegraphy are based on the same principle. The improvement introduced by Wood consists in increasing the precision of the transmitting instrument so that the size of the light-beam may be greatly diminished and secrecy thus insured, the signal being visible only at the receiving-station.



PLAN OF THE OPTICAL TELEGRAPH.

"The device consists of an achromatic lens at whose focus is a nitrogen-filled, metal-filament lamp operated by a battery of five dry piles and fitted with an ordinary Morse key. Behind the lamp is an eyepiece through which the receiving-station is exactly visible.

"When the sender looks through the eyepiece he sees the image of the lamp-filament projected against the landscape and is able to hold the device so that this image falls precisely on the receiving-station. . . . .

"With this apparatus and the nitrogen lamp, communication may be maintained up to distances of 18 or 20 miles, the diameter of the light-beam at one and one-quarter miles not exceeding six feet. The weak point of this method may be seen at once: if the trenches are very near it is impossible to communicate with the receiving-station without the enemy's also getting the signals. The system, therefore, had to be modified. Professor Wood did this by using invisible light-rays for the signals. It is well known that under this general term are included infra-red and ultra-violet rays.

"If we place before the lamp a screen that allows only these infra-red rays to pass . . . . these will not be perceived directly by the eye; but if at the receiving-post a similar device be used the observer will see the black field of his glass illuminated in red. Owing to this arrangement, secrecy is assured and the device may be used in this way at distances of five to six miles.

"To utilize the ultra-violet ray—and this is the most original feature of Mr. Wood's inventions—this scientist has succeeded in making a kind of glass absolutely opaque to the visible rays, but perfectly transparent to the ultra-violet. This glass, composed of silicate of soda and nickel oxid, therefore, looks opaque to the eye, and to observe the rays that pass through it a detector is necessary. Wood utilizes the fluorescence of some such substances as platinocyanid of barium. In these conditions the range is five to six miles."

For marine signaling, where a greater range is necessary, Professor Wood, we are told, increases the intensity of the ultra-violet ray by using an ordinary mercury vapor-lamp surrounded by a screen of the special glass just described. If a ship carries two invisible signals of this sort at a standard distance apart, the observer, looking through his detector, can tell how far away she is. To quote further:

"At the entrance of a port, in a channel, if the buoys are painted with a flourescent substance and the ship is supplied with a projector of ultra-violet rays, when the invisible beam strikes the buoy it will shine out clearly.

"To facilitate the landing of airplanes and the marking of aviation fields, the ultra-violet rays may be similarly used. The aviator seeking to land examines the ground with a glass having a fluorescent screen and finds his field by its fixed ultra-violet signals.

"Wood's investigations, although made for military purposes, have produced results that will be more generally useful; for they give us full control of the ultra-violet rays as a source of energy."—*The Literary Digest*, 8/16.

NAVY RADIO PLAN OPPOSED.—Strong opposition to the proposed plan of the Navy Department to obtain control of all trans-oceanic radio equipment was developed at a hearing held before the Senate Committee on Naval Affairs on August 28. Representatives of commercial radio companies as well as representatives of business associations objected to the continuation of the present control of the navy during times of peace. Oscar K. Davis, secretary of the National Foreign Export Association, criticized naval control of radio and cable communication in the Pacific on the grounds that transmission of messages between the Pacific Coast and the Orient was being delayed more than a week. George McK. McClellan, representative of the Honolulu Chamber of Commerce, also opposed the retention of trans-oceanic communication by the Navy Department, declaring that under the present management facilities for the transmission of commercial messages are congested to such an extent that the cable and wireless communication is rendered almost as slow as the mails.—*Army and Navy Journal*, 9/6.

GOVERNMENT WIRELESS STATION.—According to the U. S. Bureau of Census, it is learned that the government has erected wireless plants at various points along the Atlantic and Pacific coasts and at Pearl Harbor, Hawaii, and Cavite, in the Philippines. The government shore stations, according to the reports of the Bureau of Navigation, numbered 135 on June 30, 1918, of which 88 were in continental United States, 20 in Alaska, 19 in the Philippines, 3 in the Canal Zone, 2 in Hawaii and 1 each in Porto Rico, Guam, and Samoa. The government ship stations totaled 470. The station at Arlington, Va., has been in regular communication with the station at Chollas Heights, near San Diego, Cal., since May 1, 1917. Direct communication with an Italian government station in Rome was also established. On September 29, 1917, radio communication was established between Arlington and Pearl Harbor, Hawaii, via Sayville, N. Y. Messages are now transmitted between Arlington and the Philippines through San Diego, Cal., and Pearl Harbor, Hawaii. Under favorable conditions, at night, the Arlington station can communicate directly with the Pearl Harbor station, but the usual practice is to relay through San Diego.—*Scientific American*, 8/30.

FIRES STARTED BY WIRELESS.—After that blazing airship fell in the "Loop District" of Chicago, killing a dozen people and completely wrecking a great bank, some one recalled that it had passed near a high-power wireless plant and suggested that the gas in the balloon might have taken fire from a wireless spark or wave. Whether this spectacular accident was due to this or some other cause, it is at least certain that our progress in both aviation and radiotelegraphy is likely often to bring wireless waves into close touch with highly inflammable gas-bags carrying people and valuable cargoes. And the Chicago catastrophe lends immediate interest to the announcement of a French scientist, Mr. George A. Leroy, of the Municipal Laboratory of Rouen, France, that he has proved that an ordinary wireless telegram may actually start a fire. His investigations were described by Jacques Boyer in an article contributed to the *Scientific American* (New York, June 14). Mr. Leroy's discovery was stimulated by several lawsuits in which fires were asserted to have originated from the electric waves set up by wireless apparatus. He showed the correctness of these charges, or at any rate indicated their probability, through an apparatus of his own, named by him an "igniting resonator." By its means Mr. Leroy has set on fire combustible materials several yards away, the wave intensity at this distance being comparable to that produced at far greater distances by the powerful wireless apparatus commonly in use. Writes Mr. Boyer, in substance:

"The igniting resonator, as set up for Mr. Leroy's experiments, consists of a glass bulb with four apertures, operated as a resonator of the classical Hertz type, but with the spark occurring in a closed vessel, in contact with various inflammable substances which are there submitted to test. The upper aperture in the vessel is closed by a stopper through which pass a manometer, a thermometer, and a drainage-tube with a cock. Opposite it, the lower opening gives passage, through heavy packing, to a wire that supports, inside the vessel, a light table of mica on which are placed the inflammables for test; also to a second drainage-tube with a cock, which meets the upper one already mentioned.

"The entire bulb is immersed in a bath of oil of vaseline, itself enclosed in an inverted bell-vat. Once this igniting resonator was ready for action, Mr. Leroy projected upon it feeble Hertzian waves, producing these by means of an induction coil.

"This rudimentary apparatus enables the skilled experimenter to show without doubt the incendiary action of the Hertzian waves, although their electric intensity is a minimum in comparison with the power of the large wireless stations now in service. In particular, Mr. Leroy has set up at some meters' distance inflammation of combustible materials such as guncotton, tinder, cotton, worsted, tow, paper, etc. For example, by his observations upon small bales of cotton enclosed in jute wrappers with iron bands, as this material is ordinarily packed for shipment, he explains in the following fashion the mechanism of so-called spontaneous combustion which at times bursts out in warehouses or on board ships:

"In the course of handling, one of the hoops which encircles the bales of raw cotton breaks or comes loose under the action of shock or some other cause, and a small fragment of the metal projects in such way as to form a miniature Hertzian resonator. Then, under the influence of the wireless waves sent out from some station, sparks pass and immediately inflame the covering of the cotton in their immediate vicinity. Equally, the contact between the metallic bands of the bales, piled one on another in a car or packed in the hull of a boat, may establish an electric circuit offering the conditions of capacity and self-induction necessary for the production of the phenomena of resonance. In consequence, when the circuit finds itself interrupted by imperfect contact between two bales, incendiary sparks, apt to inflame the cotton, are likely to be produced."—*The Literary Digest*, 8/9.

ORDNANCE AND GUNNERY

U. S. NAVY'S NEW TYPE RAILWAY MOUNT.—Tests with most satisfactory results were made early this month at the Navy's new proving ground at Dahlgren, Va., of a new U. S. Navy type of fourteen-inch railway mount, Mark II, designed for use in high angle ranging work, and has a mobile mount for proving ground use. This mount was evolved by the Bureau of Ordnance, Navy Department, of which Rear Admiral Ralph Earle is chief, to meet conditions requiring rapid shifting from one place to another on the battlefront. The Mark I mount, which was used successfully on the west front during the latter months of the war, required about a day's time to prepare for firing, owing to the necessity of digging a pit and constructing a foundation therein to take the recoil load of the gun. The use of this pit also limited the amount of train which could be obtained in any one emplacement, this amount of train being about two and one-half degrees, which was provided on the gun girder to traverse it through this angle.

The Mark II design was gotten up to permit firing from the rails without the necessity of digging a pit and any degree of train could thus be obtained by the use of a circular track. The height of the trunnions was consequently raised so that the gun could be elevated to an angle of 40 degrees, and still clear the track. In this position, however, the total height of the gun in a level position was so great that it was not possible to transport it under bridges, through tunnels, etc. To meet this condition it was therefore necessary to provide an elevating arrangement so that the gun could be raised into its firing position and lowered into its transporting position to come inside the clearances specified for French railways. To do this the deck lugs, instead of being rigidly bolted to the gun girder, were mounted on slides inclined at an angle of forty-five degrees, and two hydraulic rams, one on each side, were fitted for raising the gun, and its carriage. To secure the carriage or gun girders in both the elevated and lowered positions heavy auxiliary trunnion pins were provided to pin the deck lugs to the gun girders. The firing load and also the dead load were thus transmitted to the gun girders by means of these pins and the slides fitted as described at an angle of 45 degrees.

The deck load of the whole mount is carried by four sets of trucks with five axels to each truck, thus making a total of 20 axles or 40 wheels. The overall wheel base is about 83 feet. With the load thus distributed, no reinforcement of the track is necessary. The use of five-wheel trucks involved a new design of equalizing system in order to insure that each axle would carry its share of the load, and this detail had to be worked out by the bureau designers co-operating with the design section of the Baldwin Locomotive Works Company. On the front end of the gun girder gasoline engines are fitted, one to drive a hydraulic pump necessary to elevate the gun to its firing position, and another motor which can be connected either to the winch for traversing the mount along the rails or to an air compressor which is utilized to furnish air pressure for gas ejecting for the operation of the breech mechanism and for assisting the springs in bringing the gun back to battery at high angles of elevation. The counter recoil springs, being the same as used for turret mounts, were naturally not designed strong enough to do this work at the high angle of elevation of 40 degrees. In addition to the power-driven hydraulic pump four hand pumps are supplied as an auxiliary means for elevating the gun to its firing position in case the power system is out of order. Owing to the great weights to be raised, however, this system, although effective for the purpose, is naturally very slow.—*Army and Navy Journal, 9/6.*

RE-GUNNING A BATTLESHIP'S TURRETS.—How long do guns last? Visitors to battleships of the United States Navy often ask that question, after seeing huge naval guns at close range for the first time. The answer surprises them, for they invariably think that guns last indefinitely, and once

installed in a turret remain there until the ship becomes old and obsolete and is eventually placed out of commission.

Modern cannon are comparatively short-lived. The cannon of past decades were smoothbores which fired round shot and, although the scouring effect of powder gases might enlarge the bore to almost any extent, the question of accuracy was of no great importance. Gunners did not ignite the fuse until they "saw the whites of the enemy's eyes." In order to accomplish this the daring captain always endeavored to get into close range and even lash his ship alongside the enemy, depending upon the ability of his gunners to fire more shots, than the latter, thus winning a quick decisive victory. Besides it was practically impossible for the old style cannon balls to penetrate the thick wooden hulls of the men-of-war of the age except at close range.

High-powered naval rifles are built of sections superimposed upon a rifled tube or liner. At first the liners were cylindrical, but to facilitate removal they are now made conical in shape on the outside. The outer sections, usually known as hoops are shrunk on to the liner by the application of heat, the outer diameter of the liner being slightly in excess of the inner diameter of the hoop shrunk upon it. This construction is known as the principle of "initial tension"—*i. e.*, the increased resistance of a tube constructed of several concentric cylinders assembled over a single tube causes a stress between them. This stress is one of compression on the inner cylinders and extension on the outer, and necessarily varies in intensity. The resultant stresses increase the resisting power of the gun to internal pressure.

After the tube and hoops are assembled the gun is rifled. This consists of cutting spiral grooves in the bore, which is done in order to impart a rotary motion to the projectile, thus preventing it from tumbling during its flight from the gun to the target. As both gun and projectile are made of steel, it is necessary to fit a comparatively soft though tough copper rifling band near the base of the shell. The rifling cuts into the band as the shell advances through the bore, thus imparting a spinning or gyroscopic motion. As it speeds on its way the longitudinal axis of the shell is always tangent to the trajectory or curve of flight.

The intense heat caused by the expansion of gases produced by the burning powder is imparted to the walls of the gun, and the speed of expansion of the gases as they propel the projectile through the bore, scours the interior surface of the metal and quickly wears out the rifling. This is known as "erosion." When erosion progresses to the extent that accuracy of flight is impaired, the gun must be relined. Thus it may be inferred that the life of a gun is measured by its accuracy. The actual number of shots which can be fired from naval guns of varying calibers before accuracy is seriously impaired, has been determined by experience, and in the United States Navy is over 250 rounds.

In order to maintain the navy at the highest point of efficiency in gunnery, target practice is frequently held under conditions closely simulating actual battle. As a result, the guns wear out and must be replaced. It is a fixed policy of the navy extending over years, that all guns mounted on board ship must at all times be capable of firing their full battle allowance of ammunition without loss of accuracy. The battle allowance depends upon the limited space for stowage in the magazines; and when it is understood that the weight of a 14-inch shell is 1400 pounds and a full charge of powder with its container weighs 323 pounds, a total of 1723 pounds, occupying 12.5 cubic feet, the great amount of space, required for the stowage of ammunition for the twelve 14-inch guns of our modern superdreadnoughts can be realized.

The navy maintains a reserve of guns on shore amounting to 25 per cent of the number afloat. These reserve guns are kept in excellent condition, ready at a moment's notice to replace those which have become worn out. The operation of replacing turret guns is one of the many things the navy

has to do in order to be ready at all times to perform its allotted task. The work must be speedily done, for a battleship laid up at a navy yard is a dead loss to the fleet.

When it becomes necessary to replace the guns of a battleship, the latter proceeds to a navy yard where new guns shipped from the reserve stock at the Naval Gun Factory awaits her. Workmen swarm on board and in a short time remove the turret top and front plates. The delicate gunsights whose working parts are machined to a ten-thousandth part of an inch are carefully removed and as carefully stowed away. The slightest burr or scratch might easily cause the gun to be fired with such great inaccuracy as to be entirely useless. Gun elevating gears and recoil cylinders are disconnected, electric firing circuits are removed and the turret has the appearance of being hopelessly dismantled. When all gear is cleared away, a huge floating crane comes alongside and lifts the gun and sleeve out of the turret, transferring it to blocking on shore. The sleeve is removed and placed on the new gun and the latter is then hoisted on board. A 14-inch gun without accessories of any sort weighs 198,000 pounds—a mass which cannot be toyed with.

After the new guns have been installed in place, the turret top and front armor plates are bolted on. Gunsights, elevating gears and all other mechanisms are assembled, and then a most important operation is commenced. The interior of the turret is thoroughly scrubbed and painted by the turret crew, while the turret captain and gunner's mates clean and polish the guns.

Worn-out guns are by no means consigned to the scrap heap, for they have many years of usefulness before them. The Naval Gun Factory has a large stock of liner forgings always on hand ready to be inserted in guns whose accuracy has been impaired by continuous use. There thousands of the most skilled mechanics in the world work day and night to keep pace with the navy's requirements. When the worn-out gun arrives it is placed on end in a vertical furnace where it is heated, after which the old liner is knocked out and a new one inserted. For this operation the gun is placed muzzle down in a furnace and heated to a temperature varying from 400 degrees F. to 500 degrees F. A powerful crane lifts the new liner to a position over the furnace and lowers it into place after which it is cooled by sprays of cold water. Hydraulic jacks are used to prevent the liner from crawling out during the cooling process.

When the gun is perfectly cool it is removed from the furnace, and placed in a lathe. It is then chambered, rifled, and fitted with breech mechanism. After being carefully inspected by an officer it is sent to the Naval Proving Ground for test by firing. At the conclusion of this test it is ready for issue to the service, as good as it was when entirely new.—*Scientific American*, 8/16.

AN ANTINOISE TELEPHONE.—"Since the days of its earliest development, the telephone has been tried out at various times for communication from bridge to engine-room and between other parts of power-propelled vessels. That it has been found conspicuously wanting in these trials is apparent from the fact that communication from bridge to engine-room, and *vice versa*, is still chiefly effected by means of such mechanical and electro-mechanical devices as the ship's telegraph, etc., and even by the antediluvian speaking-tube.

"With the enormous use of the airplane as a fighting and observation unit during the European war, there developed constantly new reasons why rapid and efficient means of inter-communication were necessary—both between the pilot and the bombers or observers aboard the same craft, and also from airship to ground and the reverse (in the latter case, of course, by means of wireless telephony).

"To those who have been in the vicinity of unmuffled gasoline or other internal-combustion engines under test, it is superfluous to say that the noise they emit precludes any sort of conversation near by—except, of

course, by some means such as sign language. With the twelve cylinders of a Liberty airplane motor exhausting directly into the air alongside the fuselage of an airplane (or, in the case of a twin-motor plane, twenty-four cylinders), the problem of providing easy communication among the crew of that airplane seemed, at first glance, impossible of solution. The tendency of a telephone transmitter of any type previously developed to pick up every noise in its vicinity, as well as the vibrations of the voice directed against it, is only too well known to those who have attempted to use the telephone in any noisy locality. This evil is known in telephone parlance as 'side-tone,' and the best brains of the telephone engineering profession had been combating it for years.

"Confronted with such a problem as this, Edwin S. Pridham and Peter L. Jensen, engineers of the Magnavox Company of San Francisco and pioneers in the adaptation to commercial use of the electrodynamic principle in telephone receivers, took one of the boldest steps ever taken in telephone development, and, by so doing, produced the Magnavox 'anti-noise' telephone transmitter.

"It was this transmitter, invented by these two Californians under war-pressure . . . . that enabled virtually perfect telephonic intercommunication among the members of the crews of America's combat airplanes, and equally efficient wireless telephone communication with the ground, from heights as great as ten thousand feet."

How Jensen and Pridham solved the problem of overcoming the noise of two thundering, unmuffled Liberty motors and enabling the use of telephones only a few feet from them is interesting because the step they took was both simple and daring. We read:

"Every previous attempt made by telephone engineers—many of them world-famous—to overcome outside noise influence or 'side-tone' in the telephone transmitter had been by trying to exclude noise with 'sound-proof' cases, padding and the like.

"Pridham and Jensen boldly opened the diaphragm and button of the transmitter and let all the noise in—impartially to both sides of the diaphragm. The result was entire exclusion from the circuit of every sound save the voices of the users; and the inventors at once patented the method, the extreme simplicity of which impresses itself forcibly on every one who hears a demonstration.

"The idea is simple. Conceive a big Chinese gong or tomtom struck on both sides at once, in the same spot, by hammers of equal weight. The blows being equal, the gong will not vibrate. But if a light tap be administered on one side only, at the same time, with a smaller hammer, the gong will vibrate in proportion to the tap of the little hammer. In the case of the transmitter, the outside noise (affecting both sides of the diaphragm equally) is analogous to the two hammers; the voice waves to the smaller hammer.

"All of this brings us back to the question of telephone intercommunication between the bridge of a steamship or motorship and the noisy parts of the ship—main engine-room, refrigerating engine-room, steering engine-room aft, boiler-room, wireless-room, etc. Demonstrations of the performance of the Magnavox 'antinoise' telephone under severe and actual service conditions convinced the representatives of the Emergency Fleet Corporation that it was the long-desired means of unimpeded telephonic intercommunication amid the perpetual din in the vitals of a power-driven ship. As a result, merchant ships now under construction in Pacific coast shipyards are being equipped with Magnavox 'antinoise' marine telephones.

"These marine telephones embody not only the same transmitter that revolutionized intercommunication on board and to and from army and navy airplanes, but also the electrodynamic type of telephone receiver, which is far superior in speech reception and reproduction to the old type of electromagnetic receiver employed in the familiar commercial form of telephone.

"In addition to embodying these two vital features, the 'antinoise' transmitter and the electrodynamic receiver, these instruments bear ample evidence of having been carefully and thoughtfully designed to meet all of the unusually severe conditions that must be met by electrical apparatus of any form on board ship. . . . .

"A word here about the technicalities of the electrodynamic type of telephone receiver may not be amiss. In this form of receiver, the vibrating element is a flat coil of wire, and not a soft iron diaphragm, as in the old electromagnetic type. This flat coil of wire is rigidly attached to a bronze diaphragm, in such a position that it cuts the lines of magnetic force passing between the pole pieces of a permanent magnet. The passage of the fluctuating voice-currents through this coil causes it to vibrate in this magnetic field synchronously with the vibrations of the transmitter diaphragm at the other end of the circuit; and inasmuch as the coil is always at a fixed distance from the pole pieces of the magnet, the reproduction of speech effected by it, through the attached receiver diaphragm, is far clearer and more faithful to the original than ever has been attained by the common or electromagnetic type of receiver. . . . .

"One unique test that was made consisted in placing a telephone equipped with the 'antinoise' transmitter inside the steel shell of a boiler. With several men outside the boiler pounding on the shell with hammers, a person inside was able to telephone to those on the outside without interference from the din of the hammering."—*The Literary Digest*, 6/14.

ENGINEERING

PRESENT STRIKING USE OF X-RAY IN METALLURGY.—Progress in the examination of solid materials with the X-ray has been rapid in recent months and some surprising results have been recorded. This is particularly true of British and French research. The facts were brought out at a recent meeting in England.

One of the earliest applications of the X-ray to metallurgy was in the detection of flaws in steel and other metals. Recent experience shows that, with the present apparatus available, it is possible to detect very small flaws in steel two inches thick. London experimenters announce, however, that apparatus has lately been devised with which it is confidently expected to penetrate steel up to nine inches thick. French cast-steel brackets for gun carriages have been shown by this test to be faulty, and the method of manufacture was changed resulting in a correction of the defects. The entire internal structure of cartridges and high explosive shells has been profitably examined without injury to the object and welds have also been found imperfect by the same agency. The application of these developments opens up a wide field of advantage to the metallurgist.

Still more interesting is the possible use of the X-ray in analysis. When the percentage of an element of high atomic weight such as tungsten is considerable, as in tool steel, the metal is not so permeable to the rays as when the percentage is low. It appears possible to apply radiography to rapid analysis in particular cases, as the separation of carbon from tungsten and alloy steels.

Another valuable development involves the examination of carbon electrodes for electric furnaces. The suggestion is made that the best use of radiographic examinations would probably consist in systematic experiments on electrode manufacture where variations in composition, baking temperature, etc., would proceed step by step. Internal causes resulting in premature and frequent breaking in service may thus be detected. Already the visual examination of aircraft timbers has yielded valuable results. No difficulty has been found in detecting concealed knots, resin pockets and grub holes, or excess or deficiency of glue in glued joints.

Examination of materials without destruction of the object has been a desideratum for many years. Its partial realization seems nearer as inves-

tigations proceed. Not only radiography but magnetic analysis are important factors in this evolution. Further work must decide to what degree these new developments in radiography will result in non-destructive testing. Already the results are striking and the goal nearer.—*Scientific American*, 8/23.

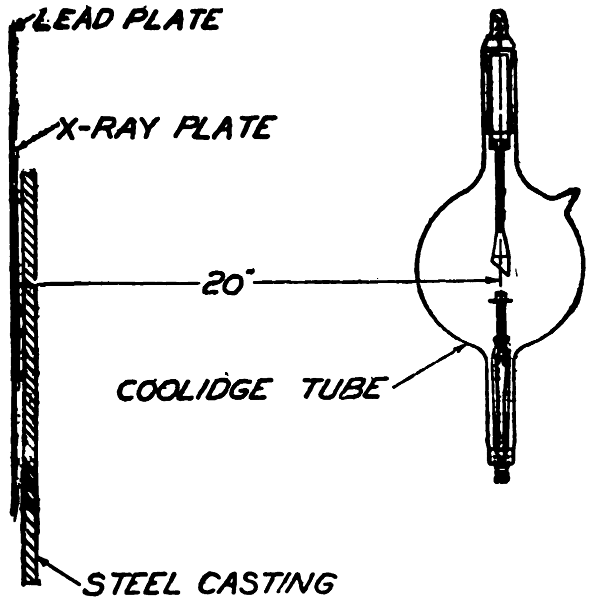


DIAGRAM OF ARRANGEMENT OF COOLIDGE TUBE FOR TAKING RADIOGRAPHS OF STEEL CASTING.

ELECTRIC SUPER-SUBMARINES.—Designs for a new type of super-submarine have been elaborated by Capt. Norman Wood, R. A. F., who recently read two papers on the subject before the Institute of Marine Engineers in London. Previous to his connection with the Royal Air Force, Captain Wood was engaged on submarine work and had practical experience of the deficiencies which exist in the design of even the latest vessels. On the surface submarines are driven by Diesel oil engines; under water they are driven by electricity from storage batteries which must be charged when the vessel is on the surface. These conditions are usually met by arranging the following chain: (1) Diesel engine, (2) clutch, (3) electric motor, (4) clutch, (5) propeller shaft. It is not difficult to see that this equipment involves a complex series of operations at critical times, as, for instance, when the vessel is caught by an enemy searchlight when the batteries are being charged. Captain Wood, continues *Electrical Review*, proposes to simplify the transition from engine drive to motor drive (or *vice versa*) by adopting an all-electric drive, using, in a 1200-ton boat, two oil engines to drive electric generators supplying current to electric motors used on propeller ships, both naval and mercantile, on the ground that the growth of air power will render submersion the only means of escape from aerial attack. From this standpoint sea power will include air power and submarine power as well as strength in ships of the old type.—*Scientific American*, 8/23.

LIBERTY MOTOR WITH TWENTY-FOUR CYLINDERS.—An experimental test of a 24-cylinder Liberty X-type motor recently conducted at McCook Field shows that this motor compares favorably with successful tests of foreign motors of approximately the same horsepower. The test engine was built of standard Liberty 12 parts, involving few changes, consisting in the main of two regular crank case upper halves, one somewhat altered, and special design connecting rods. Compared with the Liberty 12, the 24-cylinder shows 673 horsepower to 400; 1.97 pounds per horsepower to 2.11, and .55 pounds per horsepower gas consumption to .51. It is stated that an engine of this power, if run at the normal speed, would enable the use of a comparatively large slow-speed propeller without gear reduction, thus increasing propeller efficiency. Only one foreign motor has greater horsepower, the DeDion with 800, and but two are of less weight per horsepower, the Samson 18-ounce and the Napier "Lion," 1.76 and 1.86 pounds respectively. The expansion of the Liberty to 24 cylinders, explosive engine experts assert, proves it to be among the foremost all-purpose designs ever produced.—*Army and Navy Journal*, 8/30.

A NEW MAGNESIUM ALLOY.—A metal lighter than any yet known, and as strong as or stronger than steel, has for years been the dream of many, and every now and then rumors are circulated to the effect that at last it has been discovered. The advantages which such a metal would have, especially for aircraft, are obvious, but unfortunately it is generally found on investigation that there is a "snag" somewhere. The latest report to be circulated relates to a new magnesium alloy, said to have been discovered by a metal company of Montreal, Canada. The new alloy, it is stated, is only two-thirds the weight of aluminum and is "as strong as steel." It is said to be especially suitable for pistons and connecting rods of aero and motor car engines. It is to be hoped that some of the qualities attributed to the new alloy may, on closer examination, be substantiated.—*Scientific American*, 8/30.

AERONAUTICS

PARACHUTING FROM A PLANE.—The parachute as a means of escaping from a damaged airplane has been much discussed, but its use has not yet assumed a practical aspect. The Germans are said to have practised it to some extent, but Lieut.-Colonel H. S. Holt, who writes in the "Aeronautical Engineering" supplement to the *Aeroplane* (London), says that after making careful inquiry overseas, although he found records of some escapes of this kind, he discovered not a particle of evidence that any of them had been made while the plane was actually falling. He considers some new form of mechanism necessary, and he has devised what he calls an "autochute," or compound parachute system, in which the release of the main parachute is effected by a smaller or "pilot" parachute, which is released before the man jumps and relieves the strain on the large parachute at the moment of opening. This strain, he says, is usually a variable quantity, depending, in the case of a parachute launched from a captive balloon, on the distance it falls before opening. If the parachute is launched from a rapidly moving airplane, additional and severe strains may be thrown on the fabric. In the compound or tandem parachute system the strain on the main parachute is always the same within small limits, and can be accurately estimated. The pilot parachute opens first and then withdraws the main parachute from its case. Writes Colonel Holt:

"By simple timing devices the release of the main parachute can be delayed as long as desired; but the strain on it when opening will always be the same, because a well-designed pilot parachute attains its terminal velocity in a few feet.

"In certain cases the writer employs a secondary pilot parachute of very small diameter and made of as light and thin a material as possible, whose function is to draw out the first pilot parachute. This is only necessary where the first pilot has to be made of considerable diameter and very strong and heavy.

"Theoretically the strain on the main parachute can be reduced to any extent by varying the relative areas of the main and pilot parachutes. But practically there are limits beyond which one cannot go; as, for instance, if one made the pilot larger than the main, which would be an absurdity.

A "HOP OFF" IN THE AIR.

Jumping from a disabled plane with a double parachute. "The pilot parachute opens first, and then withdraws the main parachute from its case."

"The essentials for a good pilot parachute are smallness of area relative to the main parachute, great strength of material, and design and rapid inflation. . . . .

"The writer in practise attaches the pilot to the main by cords from the cable of the pilot to the circumference of the hole in the main. Correctly speaking, the pilot cable should be attached directly to the cable of the main at the point where the lines meet. In this way the load on the pilot parachute would be transmitted direct to the cable of the main instead of through the fabric of the main. But there are obvious practical objections to this.

"The writer has already successfully employed this compound system in his large parachute flares, and to adapt it to life-saving parachutes was merely a matter of modifying details and proportions to suit somewhat different conditions."

In the type of "autochute" shown in the illustrations the main parachute is carried on the aviator's back in a sort of knapsack with a spring lid. The cable connecting it with the pilot is secured to the harness with a spring-bolt, which is either released automatically at once or can be held back at the pleasure of the flier. The method of operation is as follows, as described by Colonel Holt:

"The pilot parachute is withdrawn and held in the hand, and the man gets in a position to jump overboard. The instant before jumping he releases the parachute, which opens as soon as he begins to fall and draws out the main parachute.

WITH PARACHUTE ON BACK.
The aviator is ready for a drop to earth.

"In certain circumstances he may wish to fall for a considerable distance under the pilot parachute only. Thus if he found he was close to the coast and was afraid the main parachute might drift out to sea before it reached the earth, he might wish to fall very quickly to within a few hundred feet of the ground. Or, again, in wartime, if the passenger thought the enemy airmen would attack him with their machine guns while falling, he could drop under the small pilot until near the ground, and then release the main.

"In this case before jumping off he will turn the lever on the harness, thereby locking the release-bolt so that the main parachute is not withdrawn. Until he releases the lever the main parachute will be retained in its receptacle.

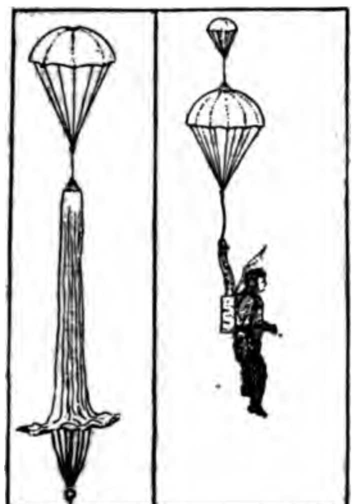
"When falling under the parachute a man is apt to grip and cling on to anything that he can get hold of, and the lever locking this bolt is arranged in such a way that he cannot do this, and the moment he lets go of the lever the bolt will be released.

"At the moment the cords become taut the strain falls on the pilot parachute, which acts as a brake on the whole system and lessens the shock when the main parachute opens to full expansion a moment later. Thus

the shock due to the coming into action of the parachute system is divided into two portions separated by a fraction of time from one another. For this reason it seems probable that shock-absorbers will be quite unnecessary in the compound parachute system. The relative proportion of the two shocks depends chiefly on the relative sizes of the two parachutes . . . .

"There is much less suction from the aperture at the apex or the center of the parachute than there is with a single parachute, the reason being that during the withdrawal of the main parachute there is hardly any motion of translation of this parachute beyond a leisurely fall of a few feet per second, due to its weight acting on the pilot parachute.

"This suction is one of the greatest dangers in connection with parachutes, as it causes a vacuum between the folds of the parachute and effectually prevents its opening. But even such small amount of suction as might be present is entirely eliminated by the device the writer has adopted of closing the central hole with a disk of specially flexible paper.



HOW THE TWO PARACHUTES WORK.
In "parachuting from a plane."

This is arranged to be easily replaced each time after use. It remains intact till the pressure inside the parachute becomes sufficient to burst it. With this arrangement and the system of tubes already described it matters very little how the parachute is folded, and nothing in the nature of skilled attendance is necessary."—*Literary Digest*, 8/2.

99 PER CENT OF AIR SERVICE EQUIPMENT READY TO USE.—The following statement was issued by the statistics branch, General Staff, War Department:

The latest reports from the Air Service show over 4500 active type planes and over 15,800 active type engines at fields and depots, of which 99 per cent are in condition to use.

In the following tables are shown the status of the planes and engines at the Air Service fields and depots as of June 30, 1919:

Planes	Total	In condition to use	Per cent of total in condition to use
Experimental	346	346	100
Active	4,547	4,488	99
Obsolete	1,865	1,854	99
Obsolescent	2,670	2,544	95
Total	9,428	9,232	98
Engines			
Active	15,823	15,788	99.8
Obsolete	2,865	2,822	98
Obsolescent	10,457	10,117	97
Experimental	993	945	95
Total	30,138	29,672	98

—*Aerial Age Weekly*, 8/25.

American Altitude Record.—The breaking of the American official altitude mark by Roland Rohlfs on July 30 was accomplished under great difficulties. For thirty minutes Rohlfs drove his machine at 150 miles an hour, 30,000 feet above the earth, in a temperature of 25 degrees below zero, in a vain effort to send it further upward. Throughout this period his motor was chilled, and the gale on the fringe of the earth's atmosphere was steadily driving him out to sea.

Six miles above the ground he let go his controls, climbed over the cowl, and attempted to cut the rubber pipe carrying water to his radiator in an effort to warm up the chilled motor. Failing in this, he next attempted to cut up a pillow in strips and jam it in the radiator, but the violent wind tore the strips out of his hands.—*Mid-Week Pictorial*, 8/14.

Aviation Facts.—American aviators brought down 755 enemy craft in action and lost 357. American aviators used 2698 planes at the front, of which 667 were of American manufacture.—*Infantry Journal*, September, 1919.

MISCELLANEOUS

Troop Transport Fleet Dwindling.—The huge transatlantic fleet, which transported our army back from France, is now reduced to 903,000 deadweight tons, in operation, divided as follows: Troop transports, 871,000; refrigerators, 6000; cargo vessels, 16,000. There are out of operation, awaiting redelivery, 213,000 tons to be turned over to the Shipping Board, the War Department announced.

"With the exception of a few of the faster ships," the Department said, "transports are now being redelivered as they arrive from overseas. Since August 1, 34,000 deadweight tons have been redelivered to the Shipping Board and 2000 to the navy. This brings the total army tonnage redelivered to date to 2,976,000 tons."—*The Nautical Gazette*, 8/23.

New Army Transports.—The former navy transport *Great Northern*, now assigned as an army transport, sailed from Hoboken, N. J., August 24 for San Francisco, where she and her sister ship, the *Northern Pacific*, will be used in permanent transport service on the Pacific. Their regular route will be from San Francisco to Honolulu, Manila, Vladivostock and thence to Nagasaki, Guam, Honolulu and San Francisco. When the American forces are brought out of Siberia they will take passage on these ships, which are fast ones, having a speed of 23 knots. They are equipped with Parsons turbines and burn oil fuel. They will be able to make the trip from San Francisco to Manila in 15 days, thus improving the mail service between those ports. The *Great Northern* and

Northern Pacific were purchased by the army from the Great Northern Railroad Company at the outbreak of the war and were operated by the navy as troop transports during the war.—*Army and Navy Journal*, 9/6.

MAKE-UP OF AMERICAN FORCE THAT WILL STAY IN GERMANY.—General Pershing has advised the War Department that the American forces which will remain in Germany after September 30 will consist of a little more than 6000 picked men. The names of the units and their approximate strength were disclosed by the War Department to-day, as follows:

	Officers	Men
8th Infantry	114	3,720
7th Machine Gun Battalion	16	379
2d Battalion, 6th F. A.	20	620
35th Field Signal Battalion	15	473
1st Supply Train	16	485
1st Mobile Ordnance Repair Shop	3	45
Company A, 1st Engineers	6	250
Field Hospital No. 13	6	82
Ambulance Company No. 26	5	153
Total	201	6,207

—*N. Y. Times*, 8/23.

STANDING OF VARIOUS NAVIES.—The United States Navy Year Book, just issued, shows among other things that our country is easily the second naval power of the world, being excelled in this respect only by Great Britain. The tables which give the strength in fighting ships show that the great powers stand in this order: Great Britain, United States, Japan, France, Germany, Russia and Italy. It is more than probable that at the present moment, however, Italy stands ahead of Russia, as the Bolsheviki lost some of their principal fighting units in recent engagements with the British in the Baltic and the Gulf of Kronstadt. The total number of the ships of all types, combatant and non-combatant, in the United States Navy is 778, with a total tonnage of 1,795,481. New construction now under way will greatly reduce the difference in tonnage between the British and American navies. The showing of the United States is reassuring in the present disturbed condition of the world. The number and power of the ships guarantee the safety of our shores against any possible future aggression, and the protection of our ocean-borne commerce in every quarter of the world.—*Mid-Week Pictorial*, 9/4.

SEEKS LION'S SHARE OF GERMAN SHIPS.—That Great Britain intends to insist upon having 2,250,000 tons of the 3,000,000 tons of German shipping to be divided among the Allies by the reparation commission after the ratification of peace is the statement made to the *Daily Mail* by an official of the Ministry of Shipping, who added that the position was delicate and complicated, and that intricate international negotiations were yet to be completed. Nevertheless, he was confident that Great Britain ultimately would obtain approximately what she demanded. Even then her loss in shipping during the war would exceed 5,000,000 tons.

Discussing complaints by the British ocean-carrying trade that other countries were benefitting at Great Britain's expense through the allocation of ships surrendered by the armistice, the official said this was the fortune of war. The Americans, he added, undoubtedly came out very well on paper, but it should be remembered that the ships in question were passenger ships and consequently bulked larger in the public mind than the cargo ships. Great Britain had a very large fleet of former German cargo carriers actively employed.—*N. Y. Times*, 9/11.

"BREMEN'S" FATE A MYSTERY.—There is no truth in the report that the crew of the German commercial submarine was captured during the war and returned recently to Germany, according to official information given the correspondent to-day. It was added that the British Admiralty has no knowledge concerning the fate of the *Bremen*, but that it is assumed she foundered while endeavoring to cross the Atlantic.

The report of the return of the crew of the *Bremen* to Germany was circulated on August 11 by the *Vossische Zeitung* of Berlin, which declared the men had reached Bremen. According to this newspaper the British had kept the crew prisoners, completely isolated from the world, so that the whereabouts of the missing submersible might remain a secret. Several days later official denial was made in Berlin that the crew of the submarine had arrived in Bremen.

With the British Admiralty disavowing knowledge of the *Bremen* it seems likely that the fate of this underwater craft will remain one of the mysteries of the war. The *Bremen* is supposed to have left Kiel for the United States in the early summer of 1916 with a cargo of dyes and chemicals. Since then her fate has been the subject of innumerable conjectures. At different times the vessel was reported as being on the eve of arriving at various American ports. As many times she was declared to have been captured or sunk by the British. Still further speculation ventured the theory that the *Bremen* had never sailed from Germany.—*N. Y. Times*, 8/27.

COMMONWEALTH DRYDOCK AT BOSTON—LARGEST OF ITS TYPE.—The new Commonwealth Drydock at South Boston is the largest drydock of its type in the world. There may be floating drydocks which are larger, but there are no land drydocks of greater size. It is situated off the main ship channel in South Boston, and is ideally located, both as to the harbor entrance and to the New Haven Railroad yards. The Navy Department has agreed to buy this drydock, when it is completed, from the state on a cost plus basis. At the present time it is 95 per cent completed.

The particulars as to dimensions are as follows: Length at bottom, 1170 feet; width at bottom, 114 feet, 9 inches. Depth over sill at low water, 35 feet. The size of the largest vessel which it could accommodate is 1150 feet in length; beam, 115 feet; draft, 45 feet, high water. It is built of concrete side walls with complete granite facings. It has a floating steel caisson which is brought into place by electric winches. The length of the caisson is 138 feet, 6 inches; width, 27 feet; depth, 53 feet, 6 inches.

It has been approximately under construction for the last three years, but during the war building was considerably curtailed by the shortage of material and labor. It is understood that the navy plans to make the drydock the biggest ship repair plant on the Atlantic coast and the repair plant is to be built alongside of the dock.

It is also understood that the navy plans to build docks adjacent to this dock for berthing ships. The channel leading to the drydock from the main ship channel has a mean depth of 37 feet, and the state, before turning the dock over to the Navy Department, will dredge a turning basin outside. The time required to flood the dock is one hour. The time required to empty it is approximately three hours. The dock has a capacity of approximately 50,000,000 gallons of water. The emptying machinery is five centrifugal pumps operated by electricity. The dock is emptied and filled through a series of conduits having outlets in the floor of the dock. The five Worthington pumps, composed of three large and two small drainage pumps, have a capacity of 4080 horsepower. Other facilities which the dock will have include enormous cranes, a modern ship repair plant including machine shops, carpenter shops, etc.

An extra sill has been provided near the center of the dock. The inner dock will take a vessel 635 feet long; the outer dock one 490 feet long.

The drydock in addition to its ideal location with relation to the sea, is within a stone's throw of the new army base at South Boston, the second largest army base in the country; which has just been completed and cost approximately $28,000,000. The army base is on a reserve channel in an inlet; so that steamers docking or leaving the new dock will not be interfered with by vessels going to or from the army base. A quarter of a mile away is the new State Fish Pier and Commonwealth Pier, the largest passenger and freight pier in the world. All of these piers and docks are built on made land filled in by the state, and there are wonderful possibilities of further development. In fact, it is safe to say that there is no collection of docks and piers in the world which would more readily lend itself to expansion than these Commonwealth projects in South Boston.—*Scientific American*, 8/9.

DELIVERING MAIL TO STEAMER AFTER IT HAS SAILED.—One of the contemplated uses of the airplane in peace time is that of overtaking steamers at sea for the purpose of placing delayed mail aboard. Obviously, the speed of the average airplane makes it possible to overtake a steamer several hours after it has left the port, thereby extending the mail service time that many hours.

It has also been suggested that steamers might carry small airplanes which, when the steamer neared port, might fly with bags of mail. If airplanes were employed to overtake the steamer, and one or more airplanes employed to make port some hours before the steamer, perhaps eight hours or more might be saved in trans-Atlantic mail service. However, such a scheme would call for a considerable number of machines and pilots, and would entail a notable expense.—*Scientific American*, 8/23.

WEST POINT DEATHS LED.—Analysis of the "final" casualty report received from the central records office in France shows that the European war was the most sanguinary in history.

Battle deaths among American enlisted men average 8 per thousand, among emergency officers 11 per thousand, and among regular army officers 14.

Of every 1000 officers landed in France, 330 were killed or wounded. Battle deaths were 37 per thousand for graduates of West Point against 18 for non-graduates.—*Infantry Journal*, September, 1919.

CURRENT NAVAL AND PROFESSIONAL PAPERS

Aftermath of War: (1) The Teaching of History, and its Consolations. By J. A. R. Marriott, M. P. (2) Hard Times Ahead. By J. Ellis Barker. *The Nineteenth Century and After*, August, 1919.

Torpedo-Boat Destroyers in the Making. By Commander James Reed, U. S. Navy. *Mechanical Engineering*, September, 1919.

Pulverized Coal as a Fuel for Boilers. By Edward R. Welles and W. H. Jacobi. *Mechanical Engineering*, September, 1919.

On Erosion of Guns. By Masatosi Ôkôchi. *Journal of the College of Engineering*, Tokyo Imperial University, March 31, 1919.

Dazzle Painting of Ships. By Lieut. Comdr. Norman Wilkinson, R. N. *North-East Coast Institution of Engineers and Shipbuilders*, Advance Proof, July 10, 1919.

DIPLOMATIC NOTES

FROM AUGUST 15 TO SEPTEMBER 15

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

THE PEACE TREATY BEFORE THE U. S. SENATE

FOREIGN AFFAIRS COMMITTEE REPORTS FOR RESERVATIONS.—The Senate Committee on Foreign Relations returned the Peace Treaty to the Senate on September 10, with a majority report recommending four reservations all relating to the League of Nations, and four amendments. The majority report condemned the League plan on the ground that "as it stands it will breed wars instead of securing peace." Furthermore, the report reads, "when we are once caught in the meshes of a treaty of alliance or a League of Nations composed of 26 other powers, our freedom of action is gone." The proposed reservations read as follows:

Resolved (two-thirds of the Senators present concurring herein), That the Senate advise and consent to the ratification of a treaty of peace with Germany, signed by the plenipotentiaries of the United States and Germany and by the plenipotentiaries of the 27 Allied and Associated Powers at Versailles on June 28, 1919, with the following reservations and understandings to be made a part and a condition of such ratification, which ratification is not to take effect or bind the United States until the said following reservations and understandings have been accepted as a part and a condition of said instrument of ratification by at least three of the four principal Allied and Associated Powers, *to wit*: Great Britain, France, Italy, and Japan:

1. The United States reserves to itself the unconditional right to withdraw from the League of Nations upon the notice provided in Article 1 of said treaty of peace with Germany.

2. That the United States declines to assume, under the provisions of Article X, or under any other article, any obligations to preserve the territorial integrity or political independence of any other country or to interfere in controversies between other nations members of the League or not, or to employ the military or naval forces of the United States in such controversies, or to adopt economic measures, for the protection of any other country, whether a member of the League or not, against external aggression of, for the purpose of coercing any other country, or for the purpose of intervention in the internal conflicts or other controversies which may arise in any other country, and no mandate shall be accepted by the United States under Article XXII, Part 1, of the Treaty of Peace with Germany, except by action of the Congress of the United States.

3. The United States reserves to itself, exclusively, the right to decide what questions are within its domestic jurisdiction and declares that all domestic and political questions relating to its affairs, including immigration, coastwise traffic, the tariff, commerce, and all other domestic questions, are solely within the jurisdiction of the United States and are not under this treaty submitted in any way either to arbitration, or to the considera-

tion of the council or of the assembly of the League of Nations, or to the decision or recommendation of any other power.

4. The United States declines to submit for arbitration or inquiry by the assembly or the council of the League of Nations, provided for in said Treaty of Peace, any questions which in the judgment of the United States depend upon or relate to its long-established policy, commonly known as the Monroe Doctrine: said Doctrine to be interpreted by the United States alone and is hereby declared to be wholly outside the jurisdiction of said League of Nations and entirely unaffected by any provision contained in the said Treaty of Peace with Germany.

PROPOSED AMENDMENTS.—The changes urged by the majority of the committee in its report involve these amendments:

1. To equalize the vote of the United States and Great Britain and her colonies and dominions in the League of Nations. This was offered by Senator Johnson.

2. To provide that nations which are parties to a dispute shall not vote in the adjustment of it in the League Council. This was offered by Senator Moses.

3. To restore the former German privileges in the Shantung Peninsula to China, instead, as the treaty provides, giving them to Japan, this being sponsored by Senator Lodge.

4. To eliminate the United States from participation in all the commissions created under the treaty with the exception of the Reparations Commission, the American delegate to vote, on that commission, only on matters involving international shipping, except as expressly instructed when occasion arises, by his own government. This affects 35 parts of the treaty, but is embraced in one amendment, offered by Senator Fall.

MINORITY REPORT.—The report of the Democratic minority of the Senate Committee was submitted on September 11. It argued that the amendments and reservations proposed by the majority would defeat the treaty, and would result in the sacrifice of a large number of advantages secured from Germany by a dictated peace.

VIEWS OF THE PRESIDENT.—The view of the minority was in accord with those of the President as expressed in a conference with members of the Committee at the White House on August 19. Relating to reservations, he said:

"It has several times been suggested, in public debate and in private conference, that interpretations of the sense in which the United States accepts the engagements of the covenants should be embodied in the instrument of ratification. There can be no reasonable objection to such interpretations accompanying the act of ratification provided they do not form a part of the formal ratification itself. Most of the interpretations which have been suggested to me embody what seems to me the plain meaning of the instrument itself.

"But if such interpretations should constitute a part of the formal resolution of ratification long delays would be the inevitable consequence, inasmuch as all the many governments concerned would have to accept in effect the language of the Senate as the language of the treaty before ratification would be complete. The assent of the German Assembly at Weimar would have to be obtained, among the rest, and I must frankly say that I could only with the greatest reluctance approach that Assembly for permission to read the treaty as we understand it, and as those who framed it quite certainly understood. If the United States were to qualify the document in any way, moreover, I am confident from what I know of

the many conferences and debates which accompanied the formulation of the treaty that our example would immediately be followed in many quarters, in some instances with very serious reservations, and that the meaning and operative force of the treaty would presently be clouded from one end of its clauses to the other."

The President began a speech-making tour of the country with addresses in Ohio on September 4, advocating adoption of the Treaty without changes.

FRENCH DEPUTIES FAVOR RATIFICATION.—As a result of debate in the French Chamber of Deputies early in September, it became clear that a majority of at least 350 favored ratification of the Peace Treaty with Germany. A minority of not more than 100, consisting chiefly of radical socialists were opposed to ratification.

AUSTRIAN PEACE TREATY SIGNED

On September 10, the Austrian Peace Treaty was signed at St. Germain by representatives of Austria and of the Allied and Associated Powers. The treaty, as handed to the Austrian delegates on September 2 and accepted by the Austrian Assembly, was altered but slightly from the terms originally presented.

In answer to Austrian counter proposals, the Supreme Council at Paris upon again handing the treaty to Austria, reiterated the share of the Austrian people in responsibility for the war.

RUMANIA AND CZECHO-SLOVAKIA REFUSE TO SIGN.—Upon failure of the Peace Conference to permit signature with reservations, both the Rumanian and the Czecho-Slovak delegates refused to sign the Austrian Treaty. The reasons in each case were the commercial restrictions and the guarantees to racial minorities imposed by the treaty in territories taken from the old Austro-Hungarian Empire. The chief reasons submitted by Rumania in a letter to the Council were:

First, that Article LX of the treaty held their hands commercially and economically at a time when they required absolute freedom of action in order to accomplish reconstruction; and, second, that guarantees to minorities imposed by an outside power would take away Rumania's sovereignty over newly annexed territories.

CABINET CHANGES IN BALKANS.—Paris, Sept. 11.—The governments of the only two delegations that refused to sign the Austrian Peace Treaty have resigned. Consequently the future attitude of Rumania and Jugo-Slavia on questions involved depends upon the policies adopted by the Ministries to be organized in Bucharest and Belgrade. The delegations of both countries have been given until Saturday to obtain instructions from the new Cabinets.

The Supreme Council holds that Rumania will lose Bukowina if she does not sign the Austrian Treaty which allots that territory to her. Similarly she will lose Transylvania unless she signs the proposed treaty with Hungary.

Reports that Rumania was negotiating for a separate peace with Hungary were positively denied to-day by the Rumanian Press Bureau here.

Take Jonescu is said to be organizing a new government at Bucharest.—*N. Y. World*, Sept. 12, 1919.

AUSTRO-GERMAN UNION BARRED

On September 8 the Supreme Council at Paris notified Germany that Article 61 of the German Constitution ratified on August 11 violated Article 80 of Section VI of the Peace Treaty, and that unless the article were nullified within 15 days the Allied and Associated Powers would order an extension of their occupation on the right bank of the Rhine.

The article in question provided for admission of Austrian delegates to the German Reichstag, whereas Article 80 of the Peace Treaty with Germany required that Germany "respect strictly the independence of Austria . . . . inalienable except with the consent of the Council of the League of Nations."

Germany replied on September 5 that she thought consent had been given to a spontaneous Austro-German Union. A later note delivered by the Council to Germany on September 11 in effect demanded that Germany submit a written statement accepting the Peace Treaty as transcending Article 61 of the Constitution.

HUNGARY

ARCHDUKE JOSEPH RESIGNS.—On August 23 the Archduke Joseph resigned, as the result of an ultimatum sent by the Paris Council notifying Hungary that the Allied and Associated Powers would negotiate only with a cabinet representing all parties. An accompanying telegram gave the Archduke two hours in which to vacate his office. Premier Friederich then organized a new cabinet composed chiefly of former members of the overthrown Peidl ministry.

ALLIED REPROOF TO RUMANIA.—On September 8 Sir George Clerk of the British Foreign Office was sent to Bucharest by the Paris Council with a note demanding that Rumania speedily evacuate Hungary, cease requisitioning supplies, and submit an account of material previously seized.

Premier Bratiano of Rumania, in communications on September 5 to the Rumanian representative in Paris, denied that he had received any of the numerous messages sent by the Paris Council in the preceding two weeks. He expressed the opinion that "in destroying Bolshevism in Hungary Rumania had rendered eminent service to the Allied cause," and that if the hostile policy of the Council toward Rumania continued, Rumania might cease all military support in Russia and elsewhere.

TURKEY AND THE NEAR EAST

BULGARIA TO GET TREATY.—It was announced from Paris on September 12 that the Bulgarian Treaty would probably be handed to that nation's representatives on September 16. The treaty, according to Paris reports, will promise Bulgaria an unnamed port on the Ægean, but will leave the disposition of Thrace for later discussion.

GREECE OPPOSED TO THRACIAN SETTLEMENT.—Keen disappointment was expressed by Greek delegates in Paris regarding the disposition of Thracian territory proposed the last of August by Mr. Wilson.

There is no question that the adoption of this plan cabled over by President Wilson last week as his own substitute for the Polk and Tardieu plans would discredit Venizelos with his own people beyond hope of recovery. Out of all Thrace the President would give Greece only a very small niche in the extreme southwest corner of Western Thrace, a district with 40 miles of coast line and running back from the coast about 30 miles. Furthermore, Mr. Wilson would give to Bulgaria all the northern part of Western Thrace, as well as the northwestern part of Eastern Thrace. All the rest of Eastern and Western Thrace would be given by the Wilson plan to the international State of Constantinople, under the mandate of some great power.—*N. Y. Times*. Sept. 6, 1919.

AMERICAN ADMIRAL HIGH COMMISSIONER IN TURKEY.—Washington, August 28.—Secretary Lansing to-day confirmed the report that Rear Admiral Mark L. Bristol, the American High Commissioner in Turkey, had protested to the Turkish Government against the killing of Armenians by Turks.

Mr. Lansing would not comment further on the statement beyond saying that this was in line with the action of the American Government several times during the past few years in protesting, in the name of humanity, to the Ottoman Government against the killing of Armenians. He declined at this time to go into the precise nature of the instructions which had been sent to Admiral Bristol.

The State Department announcement reads:

"Rear Admiral Mark L. Bristol, U. S. N., has been appointed High Commissioner of the United States at Constantinople. He will be in charge under the direction of the Department of State of political matters at Constantinople.

"Mr. Ravndal, who retains his title of Commissioner and Consul General, will continue in charge of commercial and similar matters at Constantinople. In political matters he will be under the direction of the High Commissioner."—*N. Y. Times, Aug.* 29, 1919.

ANGLO-PERSIAN TREATY OPPOSED.—Washington, Aug. 29.—The recently signed Anglo-Persian treaty has been submitted to the American State Department by the British Government, which has sounded out the attitude of the Washington Government toward the arrangement.

The State Department is understood to have made a reply in which it indicated that the American Government did not look with favor upon the treaty. There was an unconfirmed report to-night that the State Department has declined to recognize it.

The first agreement was political in character and promised the cementing of the Anglo-Persian ties and promotion of the progress and prosperity of Persia. According to this agreement, Great Britain agreed in the most categorical manner to respect the integrity and independence of Persia, to supply expert advisers for the Persian administration to be engaged on contract and endowed with adequate powers, to supply at Persia's cost such officers, munitions, and equipment that might be adjudged necessary by a joint Anglo-Persian commission of military experts for a uniform Persian force to preserve order, to prescribe a loan for these purposes, to co-operate with the Persian Government in railway construction and other forms of transport, and finally both governments agreed to the immediate appointment of a joint committee to examine and revise the existing customs tariff.

The second agreement related to a loan of £2,000,000 at 7 per cent, redeemable in 20 years, and to be secured on the revenues and customs reserved and assigned for the repayment of the 1911 loan. Should these prove insufficient Persia, under the agreement is to make good the difference from other sources of revenue. Article V of the Anglo-Persian agreement of 1911 is included in the understanding.—*N. Y. Times,* Aug. 30, 1919.

ITALY

FIUME SETTLEMENT REPORTED.—Paris, Sept. 3 (Associated Press).—Satisfaction is expressed in Italian circles at the outcome of Signor Tittoni's trip to Deauville, from which place he returned yesterday after a conference with the British Prime Minister, David Lloyd George.

While no official communication has been given out, it is learned from reliable authority that an agreement has been reached from which a solution of the Italian problem is expected. According to this information the three governments which are parties to the Treaty of London have decided to send a collective note to President Wilson asking him to give his assent to a compromise which the signatories consider adequate.

Some doubt is expressed, however, as to the probability of President Wilson modifying his attitude on the Adriatic question, but it is said that the compromise opens the way for the President to agree without receding from his former position.—*N. Y. Times*, Sept. 4, 1919.

RUSSIA

MORRIS FAVORS RECOGNITION OF KOLCHAK.—Washington despatches of the close of August stated that the reports of Japanese Ambassador Roland S. Morris, recently returned from an investigation of conditions in Russia, strongly recommended recognition of the Kolchak Government, and declared that had Kolchak been recognized three months ago he would have established himself firmly in power.

The reverses suffered by the Kolchak forces, however, together with the opposition expressed to the participation of American forces in Russia, made such recognition very unlikely.

FAR EAST

JAPANESE REFORMS IN KOREA.—Washington, Aug. 20.—The Japanese Embassy to-day received and made public the texts of an imperial rescript and a statement by Premier Hara, issued in Tokyo yesterday, announcing the abolition of military administration in Korea and the introduction of a civil administration. It is specifically declared by the Premier "that Korea, and Japan proper, forming equally integral parts of the same empire, no distinction should, in principle, be made between them, and it is the ultimate purpose of the Japanese Government, in due course, to treat Korea as in all respects on the same footing with Japan proper."

The system of gendarmerie in Korea is to be replaced by a force of police to be placed under the control of local governors, just as in Japan proper. It is stated that the disturbances which broke out in Korea last March retarded the introduction of the reforms. Two civilians, Baron Saito and Mr. Midzuno, have been appointed respectively Governor General and Director General of administration.—*N. Y. Times*, Aug. 21, 1919.

On August 31 leaders of the agitation for Korean independence, "representing and acting in behalf of more than 19,000,000 Koreans," issued a proclamation declaring Korea a republic.

RESIGNATION OF MINISTER REINSCH.—A Washington despatch of August 27 reported the resignation of Dr. Paul S. Reinsch, American Minister to China. His resignation was attributed to failure of the American delegates at Paris to carry out his promises to China.

MEXICO

AMERICAN WARNING TO MEXICO.—According to information published by Secretary Lansing on August 14 the United States representative in Mexico handed the following note to the Mexican Government:

Sir: With reference to the Embassy's note, dated July 16, 1919, relative to the murder of Peter Catron, near Calets, San Luis Potosi, on or about July 7 last, I have the honor to inform you that I am now under telegraphic instructions from my government to urge upon the Mexican Government the punishment of those responsible for this murder and the adoption of adequate measures to prevent a recurrence of the murder of American citizens.

I am also instructed to state that should the lives of American citizens continue to remain unsafe and these murders continue by means of the unwillingness or inability of the Mexican Government to afford adequate protection, my government may be forced to adopt a radical change in its policy with regard to Mexico.

Accept, Sir, the renewed assurances of my highest consideration.

(Signed) GEORGE T. SUMMERLIN.

CARRANZA YIELDS ON FOREIGN CLAIMS.—Mexico City, Aug. 30.—Important concessions were made by President Carranza to-day in issuing a decree amending the law on claims. Briefly they are as follows:

Claims for damages may be presented not only for losses during the recent two revolutions ending with the installation of the present government on May 1, 1917, but for those sustained since then in various regions where revolts are still smoldering.

Damages by rebels or outlaws to person or property subject to claims when such damage is found to be the result of negligence on the part of constituted authority.

A commission on idemnification will admit any means of proof "humanly reasonable." The Claims Commission can consider all cases, but the President has the right to arrange conventions with any foreign power for a mixed commission to handle claims of citizens of that power.

The most important amendment, it is considered, is that relative to the President's power to arrange conventions for mixed commissions with foreign powers.—*N. Y. Times,* Sept. 1, 1919.

More members, both regular and associate, are much desired. Any increase in membership invariably means larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

S. A. Taffinder,
Secretary-Treasurer.

Attention is invited to extracts from the constitution on the opposite page as to the requirements in making applications for life, regular and associate membership. Members and associate members are liable for the payment of the annual dues until the date of the receipt of their resignation in writing. Annual dues $2.50.

....

....*191*

To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a $\left\{\begin{matrix}\textit{regular}\\ \textit{associate}\end{matrix}\right\}$ *member of the U. S. Naval Institute from this date.*

Very truly yours,

....

....

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary member. must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the PROCEEDINGS, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The PROCEEDINGS are published monthly; subscription for non-members, $3.00; enlisted men, U. S. Navy, $2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

S. A. TAFFINDER,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problems of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887

The Naval Brigade: Its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888

Torpedoes. Prize Essay, 1888. By Lieut. Commander W. W. Reisinger, U. S. N.

1891

The Enlistment, Training and Organization of Crews for Our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892

Torpedo-boats: Their Organization and Conduct. Prize Essay, 1892 By Wm. Laird Clowes.

1894

The U. S. S. Vesuvius, with Special Reference to Her Pneumatic Battery Prize Essay, 1894. By Lieut. Commander Seaton Schroeder, U. S. N

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut. Commander Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention 1896. By Lieutenant John M Ellicott, U. S. N.

1897

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut. Commander Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903

Gunnery in Our Navy. The Causes of Its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure Its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905

American Naval Policy. Prize, Essay 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear Admiral Stephen B. Luce, U. S. N.

1906

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut. Commander A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906 By Pay Inspector J. A. Mudd. U. S. N.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A Few Thoughts on Our Next Step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut. Commander Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENCE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut. Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotton, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut. Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut. Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut. Commander Dudley W. Knox, U. S. N.

1914

The Great Lesson from Nelson for To-day. Prize Essay, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

NAVAL POLICY AS IT RELATES TO THE SHORE ESTABLISHMENT AND THE MAINTENANCE OF THE FLEET. Honorable Mention, 1914. By Captain John Hood, U. S. N.

OLD PRINCIPLES AND MODERN APPLICATIONS. Honorable Mention, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

MILITARY PREPAREDNESS. Honorable Mention, 1914. By Naval Constructor Richard D. Gatewood, U. S. N.

1915

The Rôle of Doctrine in Naval Warfare. Prize Essay, 1915. By Lieut. Commander Dudley W. Knox, U. S. N.

AN AIR FLEET: OUR PRESSING NAVAL WANT. First Honorable Mention, 1915. By Lieut. Commander Thomas Drayton Parker, U. S. N.

TACTICS. Second Honorable Mention, 1915. By Ensign H. H. Frost, U. S. N.

DEFENCE AGAINST SURPRISE TORPEDO ATTACK. Third Honorable Mention, 1915. By Ensign R. T. Merrill, 2d, U. S. N.

1916

The Moral Factor in War. Prize Essay, 1916. By Lieutenant (J. G.) H. H. Frost, U. S. N.

NAVAL PERSONNEL. First Honorable Mention, 1916. By Lieut. Commander J. K. Taussig, U. S. N.

EDUCATION AT THE U. S. NAVAL ACADEMY. Second Honorable Mention, 1916. By Lieutenant Ridgely Hunt, U. S. N.

SOME UNDERLYING PRINCIPLES OF MORALE. Third Honorable Mention, 1916. By Commander Dudley W. Knox, U. S. N.

LARGE *vs.* A GREATER NUMBER OF SMALLER BATTLESHIPS. Lippincott Prize Essay. By Lieut. Commander Thomas Lee Johnson, U. S. N.

1917

Commerce Destroying in War. Prize Essay, 1917 By Commander Lyman A. Cotten, U. S. Navy.

THE PEOPLE'S RÔLE IN WAR. First Honorable Mention, 1917. By Lieutenant H. H. Frost, U. S. Navy.

THE NATION'S GREATEST NEED. Second Honorable Mention, 1917. By Colonel Dion Williams, U. S. Marine Corps.

1918

Letters on Naval Tactics. Prize Essay, 1918. By Lieutenant H. H. Frost, U. S. N.

THE PREPAREDNESS OF THE FUTURE. First Honorable mention, 1918. By Commander H. O. Rittenhouse, U. S. N. Retired.

NAVAL STRATEGY. Second Honorable Mention, 1918. By Rear Admiral Bradley A. Fiske, U. S. N.

1919

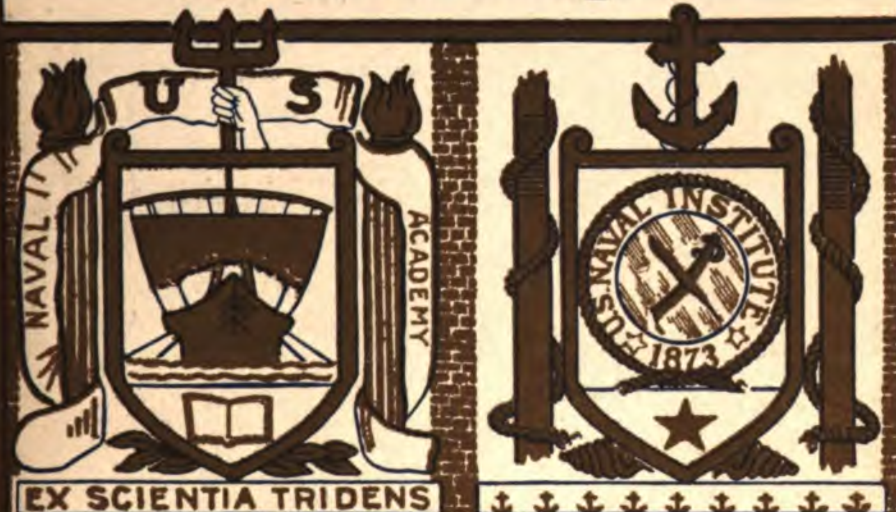
MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.

SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

VOL. 45 NOVEMBER 1919 No. 201

United States Naval Institute

Proceedings



The writers only are responsible for the contents of their respective articles

CONTENTS

Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 11 November, 1919 Whole No. 201

United States Naval Institute

Proceedings

PUBLISHED MONTHLY
EDITED BY S. A. TAFFINDER

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

CONTENTS

OFFICERS OF THE INSTITUTE

President

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

Vice-President

REAR ADMIRAL A. H. SCALES, U. S. NAVY

Secretary and Treasurer

COMMANDER S. A. TAFFINDER, U. S. NAVY

Board of Control

CAPTAIN W. T. CLUVERIUS, U. S. NAVY
CAPTAIN T. L. JOHNSON, U. S. NAVY
CAPTAIN E. J. KING, U. S. NAVY
CAPTAIN W. G. DU BOSE, CONSTRUCTION CORPS, U. S. NAVY
CAPTAIN AMON BROMON, U. S. NAVY
COMMANDER B. C. ALLEN, U. S. NAVY
COMMANDER S. A. TAFFINDER, U. S. NAVY (*ex officio*)

PAST PRESIDENTS

OF THE

U. S. NAVAL INSTITUTE

Admiral DAVID D. PORTER, U. S. Navy, 1873
Rear Admiral JOHN L. WORDEN, U. S. Navy, 1874
Rear Admiral C. R. P. RODGERS, U. S. Navy, Jan. 1875–Jan. 1878
Commodore FOXHALL A. PARKER, U. S. Navy, Jan. 1878–Jan. 1879
Rear Admiral JOHN RODGERS, U. S. Navy, Jan. 1879–Jan. 1882
Rear Admiral C. R. P. RODGERS, U. S. Navy, Jan. 1882–Jan. 1883
Rear Admiral THORNTON A. JENKINS, U. S. Navy, Jan. 1883–Oct. 1885
Rear Admiral EDWARD SIMPSON, U. S. Navy, Oct. 1885–Oct. 1887
Rear Admiral STEPHEN B. LUCE, U. S. Navy, Oct. 1887–Oct. 1898
Rear Admiral WM. T. SAMPSON, U. S. Navy, Oct. 1898–Oct. 1902
Rear Admiral H. C. TAYLOR, U. S. Navy, Oct. 1902–Oct. 1904
Rear Admiral C. F. GOODRICH, U. S. Navy, Oct. 1904–Oct. 1909
Rear Admiral RICHARD WAINWRIGHT, U. S. Navy, Oct. 1909–Oct. 1911

ANNAPOLIS NAVAL ACADEMY MIDDIES WATCHING 20,000 CUBIC FEET OF WATER A SECOND BEING DISCHARGED FROM HUGE SPILLWAY IN PANAMA CANAL LOCK.

UNITED STATES NAVAL INSTITUTE
PROCEEDINGS

Vol. 45, No. 11 NOVEMBER, 1919 Whole No. 201

A DESCRIPTION OF THE BATTLE OF JUTLAND

By Lieut. Commander Holloway H. Frost, U. S. Navy

Motto:

**" Indoctrination makes effective co-ordination possible.
Effective co-ordination makes concentration possible.**

soon after it was fought. While Admiral Jellicoe's description of the night action is the most complete thus far published, further information on this interesting phase of the battle is very desirable. A special effort has been made in this paper to reconstruct the details of this action from the incomplete information available.

The German official accounts of the battle have been contradictory, unreliable and generally unsatisfactory. This was doubtless due partly to the difficulty of determining what actually took place in a battle fought in misty weather and partly to misstatements made for propaganda purposes. The unofficial accounts of the battle are merely enlargements of the official accounts. Only a few details can be gained from the German accounts and consequently the movements of the German forces during the day, not to speak of the night, are very uncertain at some stages.

It will be noted that numerous sketches have been used. All the information available has been incorporated in them and every effort has been made to make them as accurate as possible. It must be realized, however, that their purpose is to give a general

idea of the battle, for it cannot be pretended that they show the exact tracks of all the forces at all times. It is believed that they do not contain errors large enough to give one a false idea of the action.

II. COMPARISON OF THE OPPOSING FORCES

It seems proper that before commencing the description of the action we should see how the opposing forces compared to one another. In this comparison we need consider only four classes of ships: Dreadnought battleships, battle cruisers, light cruisers and destroyers. The British had eight armored cruisers present and the Germans had six pre-dreadnought battleships. The total results gained by the armored cruisers was to cripple the light cruiser *Wiesbaden* with gunfire; except for this they merely served as excellent targets for the guns of the German battle fleet. On the other hand, the pre-dreadnought battleships proved to be perfect targets for the torpedoes of the British destroyers; in addition, their slow speed was a positive menace to the greatly inferior German fleet and after the battle they were eliminated from the High Sea Fleet. As both armored cruisers and pre-dreadnought battleships did nothing but to swell the losses of their own sides it will not be necessary to consider them in the present comparison.

Sir Eustace D'Eyncourt in a paper entitled "Naval Construction During the War" states that at the Battle of Jutland the Grand Fleet had a superiority over the High Sea Fleet in weight of broadside of 175 per cent. This means that for each pound of metal thrown in the German broadside there were $2\frac{3}{4}$ British pounds, or a superiority of nearly 3 to 1. Such a comparison is, however, unfair to the British. I have always held that the only fair basis of comparison is the displacement. When a ship of a certain displacement is designed, a certain proportion of this displacement must be allotted to the offensive armament, to armor and defensive arrangements and to the motive power. The amounts allowed to motive power by the British and German constructors were practically the same. However, the British then specialized on their offensive armament and to a considerable extent neglected their armor; while the Germans, on the other hand, specialized on their armor and defensive arrangements and to a considerable extent neglected their offensive armament. It is

amusing to see the British writers comment so bitterly upon the German superiority in armor and to see the German writers lament upon the British superiority in gunfire. It seems fair to assume that the British and German naval constructors were equally efficient and that the British superiority in gunfire counterbalanced the German superiority in armor. This is Admiral Jellicoe's opinion, for he states that "the true comparison lay between the *displacement* of the ships of the various classes."

Let us therefore obtain the displacements of the British and German battleships which took part in the battle. As there is a little discrepancy in the figures given by the various authorities, I take them directly from Admiral Jellicoe's book:

BRITISH BATTLESHIPS

	Displacement
Bellerophon	18,600
Temeraire	18,600
Superb	18,600
St. Vincent	19,250
Collingwood	19,250
Vanguard	19,250
Neptune	20,000
Hercules	20,000
Colossus	20,000
Orion	22,500
Conqueror	22,500
Monarch	22,500
Thunderer	22,500
Ajax	23,000
Centurion	23,000
King George V	23,000
Iron Duke	25,000
Marlborough	25,000
Benbow	25,000
Barham	27,500
Malaya	27,500
Warspite	27,500
Valiant	27,500
Canada	28,000
Erin	23,000
Agincourt	27,500
Royal Oak	25,750
Revenge	25,750
28 ships	647,550
Average	23,127

GERMAN BATTLESHIPS

	Displacement
Nassau	18,600
Posen	18,600
Rheinland	18,600
Westfalen	18,600
Ostfriesland	22,440
Helgoland	22,440
Oldenburg	22,440
Thuringen	22,440
Kaiser	24,410
Friedrich der Grosse	24,410
Kaiserin	24,410
Konig Albert	24,410
Konig	25,390
Grosser Kurfürst	25,390
Markgraf	25,390
Kronprinz	25,390
16 ships	363,360
Average	22,585

Thus there were 28 British battleships against 16 German; the average displacement of the British battleships was slightly greater than the German; the British were superior in total displacement in the ratio of 1.78 to 1. You will note that on the British side the *Dreadnaught, Emperor of India* and *Queen Elizabeth* were absent; on the German side one ship of the *Kaiser* class was missing; I believe this ship was the *Prinsregent Luitpold.*

We will now compare the British and German battle cruisers. I use the figures of Admiral Jellicoe:

BRITISH BATTLE CRUISERS	Displacement
Tiger	28,500
Lion	26,350
Queen Mary	26,350
Princess Royal	26,350
New Zealand	18,800
Indefatigable	18,800
Invincible	17,250
Indomitable	17,250
Inflexible	17,250
9 ships	196,900
Average	21,880

GERMAN BATTLE CRUISERS	Displacement
Derfflinger	26,180
Lutzow	26,180
Seydlitz	24,610
Moltke	22,640
Von der Tann	19,100
5 ships	118,710
Average	23,742

The British had nine battle cruisers against five German; the average displacement of the German ships was considerably greater than the British; the British were superior in total displacement in the ratio of 1.66 to 1. The British battle cruiser *Australia* was not present at the battle. The total displacement of the British battleships and battle cruisers combined was 844,450 against 482,070, a ratio of 1.75 to 1.

Admiral Jellicoe lists 26 light cruisers as having been present. According to Jane their average displacement figures at 4165. The following German light cruisers are mentioned in various reliable reports of the battle:

Rostock.	*Elbing.*	*Stettin.*	*Munchen.*
Wiesbaden.	*Regensburg.*	*Hamburg.*	*Frauenlob.*

The following light cruisers could possibly have been present:

Frankfurt	*Strassbourg.*	*Stuttgart.*	*Lubeck.*
Pillau.	*Kolberg.*	*Danzig.*	*Stralsund.*
Graudenz.	*Augsburg.*	*Berlin.*	

It is known that the second scouting group accompanied Hipper. The seaplane sent up by the *Engadine* reported sighting four light

cruisers. When Hipper turned to the southward his light cruisers followed him. At 4.08 p.m. the fifth battle squadron opened fire on these light cruisers instead of on the German battle cruisers, so that as late as this they were still well astern of the battle cruisers. At 4.15 the light cruiser *Regensburg* moved out to support a destroyer attack from a position ahead of the battle cruisers. I assume therefore that this ship was employed as a destroyer leader, thus giving Hipper a total of five light cruisers. Scheer also must have had at least two scouting groups of four light cruisers each. At about 6 p.m. the third battle cruiser squadron was engaging two groups of German light cruisers; there were three vessels in the first group, but the number in the second is not given. At the same time the first cruiser squadron was engaging three or four light cruisers of still another group. I therefore assume that Scheer had two groups of four light cruisers each in addition to the ones with Hipper and that he had two light cruisers as destroyer flotilla leaders. This gives a total of 15 light cruisers for the Germans. The *Revista Marittima* gives only 11 vessels, but I consider the larger number more probable. The average displacement of the 19 German light cruisers listed above is 4100, or practically the same as that of the British light cruisers. The superiority of the British in this class was therefore 26 to 15, or 1.74 to 1.

According to Admiral Jellicoe's list, the British had 78 destroyers; their total displacement was 77,200, an average of 990 tons per boat. Admiral Jellicoe states that the Germans had 88 destroyers; he apparently means eight full flotillas of 11 boats each. At that time there were attached to the Grand Fleet 80 destroyers, of which 70 were ready for sea, which Admiral Jellicoe states was "an unusually large proportion." The additional eight destroyers were of the Harwich force. As the Germans did not put to sea as the result of a long-considered plan, it is fair to assume that only $\frac{7}{8}$ of their destroyers were actually ready for sea, or 77 boats. On 21 February, 1919, the New York *Times* states that "it is learned officially by Reuter's that 77 German destroyers were present." The *Revista Marittima* of April, 1919, also gives the Germans this very number of destroyers. I therefore assume that 77 German destroyers were present. It is difficult to compare the German and British destroyers; the British boats carried a heavier battery of guns; the Germans had six tubes to

four for the British. It is difficult to determine the average displacement of the German destroyers. Eleven boats of 1250 or 1300 tons were completed in 1915. Assuming that all these were present, their total displacement was 14,100 for the 11 boats. No other German destroyers exceeded 750 tons, while there were various classes of destroyers of 555, 561, 640 and 700 tons, respectively, which were present at Jutland. The five boats sunk were:

V-4	561 tons.
V-27	640 tons.
V-29	640 tons.
V-48	750 tons.
S-35	700 tons.
Total	3291 tons.
Average	658 tons.

Assuming that the average displacement was 700 tons for the other 66 German destroyers the total displacement for these 66 boats would be 46,200. Therefore we have the following:

11 German destroyers:	Average displacement 1282	Total displacement 14,100
66 German destroyers:	Average displacement 700	Total displacement 46,200
Grand total		60,300

The total displacement of British destroyers was therefore superior to the total displacement of the German destroyers in the ratio of 1.28 to 1.

The British superiority in battleships, battle cruisers and light cruisers was therefore 1.75 to 1; in destroyers it was 1.28 to 1. I therefore consider their total superiority to be 1.60 to 1, or 8 to 5.

III. THE POSITIONS OF THE OPPOSING FLEETS AT 2 P. M. 31 MAY, 1916, G. M. T.

At 2 p. m., G. M. T., the main body of the Grand Fleet, under the personal command of Admiral Jellicoe, was in position Latitude 57° 57′ N., Longitude 3° 45′ E. The battle fleet was disposed in line of divisions, the line of bearing of the division flagships being 26° true and the course 116° true. The formation of the battle fleet was as follows:

DIRECTION OF ADVANCE

Second battle squadron		Fourth battle squadron		First battle squadron	
First div.	Second div.	Third div.	Fourth div.	Fifth div.	Sixth div.
King George V	*Orin*	*Iron Duke*	*Benbow*	*Colossus*	*Marlborough*
Ajax	*Monarch*	*Royal Oak*	*Bellerophon*	*Collingwood*	*Revenge*
Centurion	*Conqueror*	*Superb*	*Temeraire*	*Neptune*	*Hercules*
Erin	*Thunderer*	*Canada*	*Vanguard*	*St. Vincent*	*Agincourt*

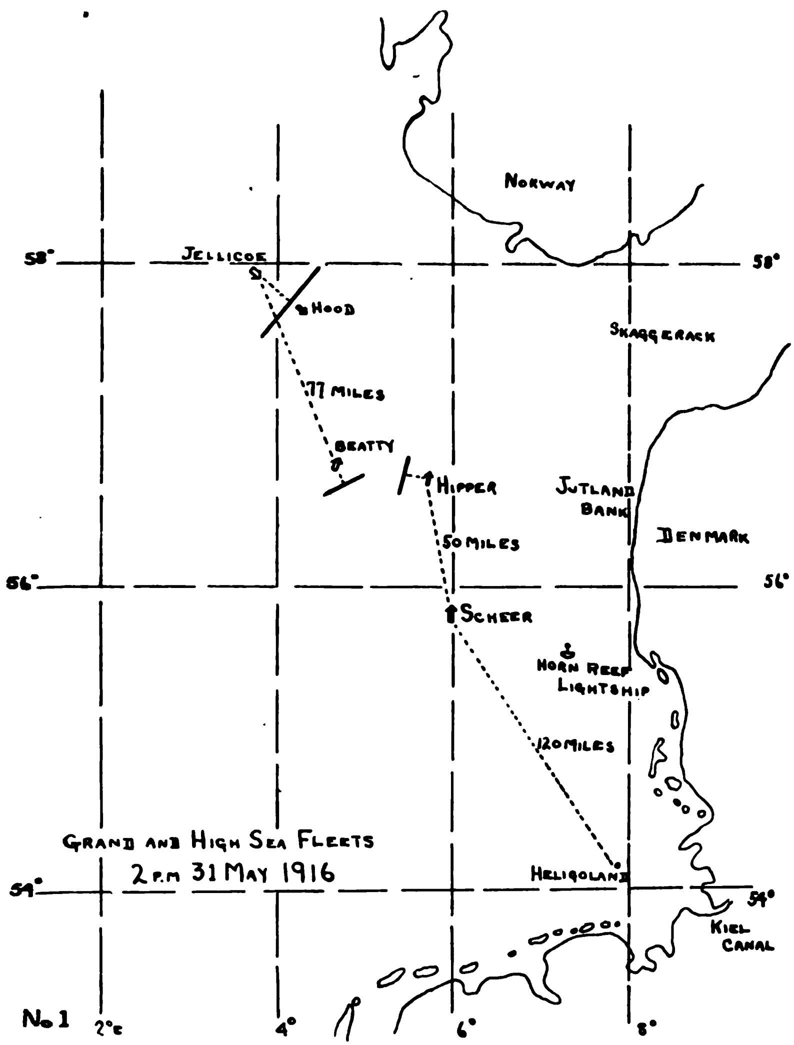

NORWAY
58°
JELLICOE
HOOD
SKAGGERACK
77 MILES
BEATTY
HIPPER
JUTLAND BANK
DENMARK
50 MILES
56°
SCHEER
HORN REEF LIGHTSHIP
120 MILES
GRAND AND HIGH SEA FLEETS
2 P.M 31 MAY 1916
HELIGOLAND
54°
KIEL CANAL
No 1
2°E
4°
6°
8°

FIG. 1.

The flagships and flag officers of the battle fleet were:

Flagship	Flag officer	Command
Iron Duke	Adm. Sir John Jellicoe	Commander-in-chief.
King George V.	Vice Adm. Sir M. Jerram	Second battle squadron.
Orion	Rear Adm. A. C. Leveson	Second division.
Superb	Rear Adm. A. L. Duff	Third division.
Benbow	Vice Adm. Sir Doveton Sturdee	Fourth battle squadron.
Colossus	Rear Adm. E. F. A. Gaunt	Fifth division.
Marlborough	Vice Adm. Sir Cecil Burney	First battle squadron.

The battle fleet was screened by 39 destroyers of the 4th, 11th and 12th flotillas. Commodore James R. P. Hawkesley, commodore of the flotillas, commanded this entire destroyer force in the light cruiser *Castor*. He also led the 11th flotilla. The fourth flotilla was commanded by Captain Charles D. Wintour in the flotilla leader *Tipperary*. The 12th flotilla was led by Captain Anselan J. B. Stirling in the flotilla leader *Faulknor*.

Three miles ahead of the battle fleet was the fourth light cruiser squadron commanded by Commodore Charles E. Le Mesurier. It consisted of the following five light cruisers:

Calliope (flag). *Caroline*. *Comus*. *Constance*. *Royalist*.

It is assumed that these light cruisers were spread on a scouting line 26° true at intervals of two miles.

Sixteen miles ahead of the battle fleet were the first cruiser squadron, Rear Admiral Sir Robert Arbuthnot, and the second cruiser squadron, Rear Admiral Herbert L. Heath. They were composed of the following vessels:

First cruiser squadron	Second cruiser squadron
Defense (flag).	*Minotaur* (flag).
Warrior.	*Hampshire*.
Duke of Edinburgh.	*Shannon*.
Black Prince.	*Cochrane*.

Six of the ships were spread on a scouting line 26° true at intervals of six miles. The *Warrior* followed close astern of the *Defense* and the *Hampshire* was six miles astern of the *Minotaur*, acting as a linking ship with the battle fleet. The formation was as follows:

DIRECTION OF ADVANCE

Cochrane. *Shannon*. *Minotaur*. (F.). *Defense* (F.). *Duke of Edinburgh*. *Black Prince*.
Warrior.
Hampshire (six miles astern of *Minotaur*).

Each cruiser was accompanied by one destroyer.

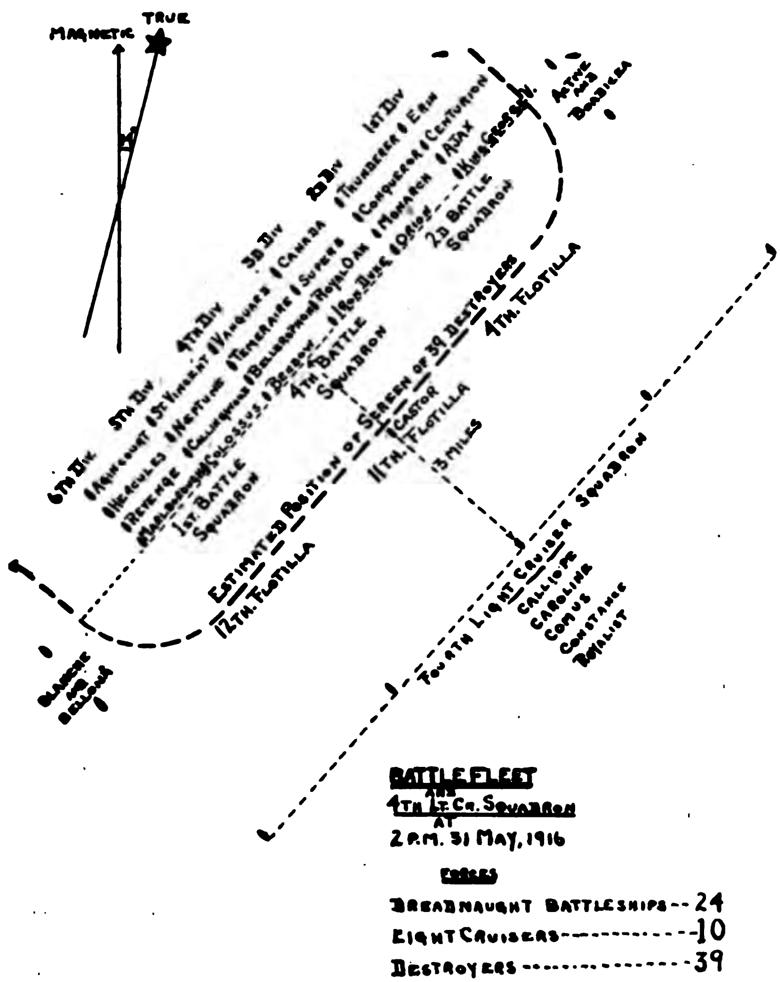

MAGNETIC
TRUE
1ST DIV
2D DIV
3D DIV
4TH DIV
5TH DIV
6TH DIV
2D BATTLE SQUADRON
4TH BATTLE SQUADRON
1ST. BATTLE SQUADRON
4TH. FLOTILLA
CASTOR
11TH. FLOTILLA
13 MILES
ESTIMATED POSITION OF SCREEN OF 39 DESTROYERS
12TH. FLOTILLA
FOURTH LIGHT CRUISER SQUADRON
CALLIOPE
CAROLINE
COMUS
CONSTANCE
ROYALIST
BATTLE FLEET
AND
4TH LT. CR. SQUADRON
AT
2 P.M. 31 MAY, 1916
FORCES
DREADNAUGHT BATTLESHIPS -- 24
LIGHT CRUISERS ---- 10
DESTROYERS ---- 39

FIG. 2.

Four light cruisers, ***Blanche, Bellona, Boadicea* and *Active*,** proceeded on the flanks of the battle fleet to act as repeating ships for flag signals.

Twenty miles ahead of the battle fleet was the third battle cruiser squadron, Rear Admiral the Honorable Horace L. A. Hood. It was composed of the following battle cruisers:

Invincible (flag). *Indomitable. Inflexible.*

The light cruisers *Chester* and *Canterbury* and the destroyers *Shark, Acasta, Ophelia* and *Christopher* accompanied the battle cruisers. The two light cruisers had just been commissioned and were making their first cruise with the Grand Fleet.

All the above forces were under the command of Admiral Jellicoe in the *Iron Duke* (fleet flagship) and were zigzagging on the base course 116° true, the speed of advance to the front being 14 knots.

At 2 p.m. Vice Admiral Sir David Beatty, commanding the scouting force, was in position Latitude 56° 40′ N., Longitude 4° 40′ E., with four battle cruisers in column formation:

Lion, flagship of the battle cruiser fleet.
Princess Royal, flagship of the first battle cruiser squadron, Rear Admiral O. de B. Brock.
Queen Mary.
Tiger.

This force was screened by 10 destroyers of the 13th flotilla, led by Captain James U. Farie in the light cruiser *Champion*.

Three miles from the *Lion* and bearing 52° true was the second battle cruiser squadron, Rear Admiral W. Pakenham. It consisted of:

New Zealand (flag). *Indefatigable.*

It was screened by six destroyers of the Harwich force.

Five miles from the *Lion* and bearing 324° true was the fifth battle squadron, Rear Admiral H. Evan-Thomas. It consisted of four fine dreadnought battleships of 25 knots speed and which carried the heavy battery of eight 15-inch guns. The ships were:

Barham (flag). *Valiant. Warspite. Malaya.*

This squadron was screened by nine destroyers of the first flotilla, led by Captain Charles D. Roper in the light cruiser *Fearless*. Two additional destroyers of the Harwich force accompanied the scouting force, but their positions are not stated. The Harwich destroyers belonged to the ninth and tenth flotillas.

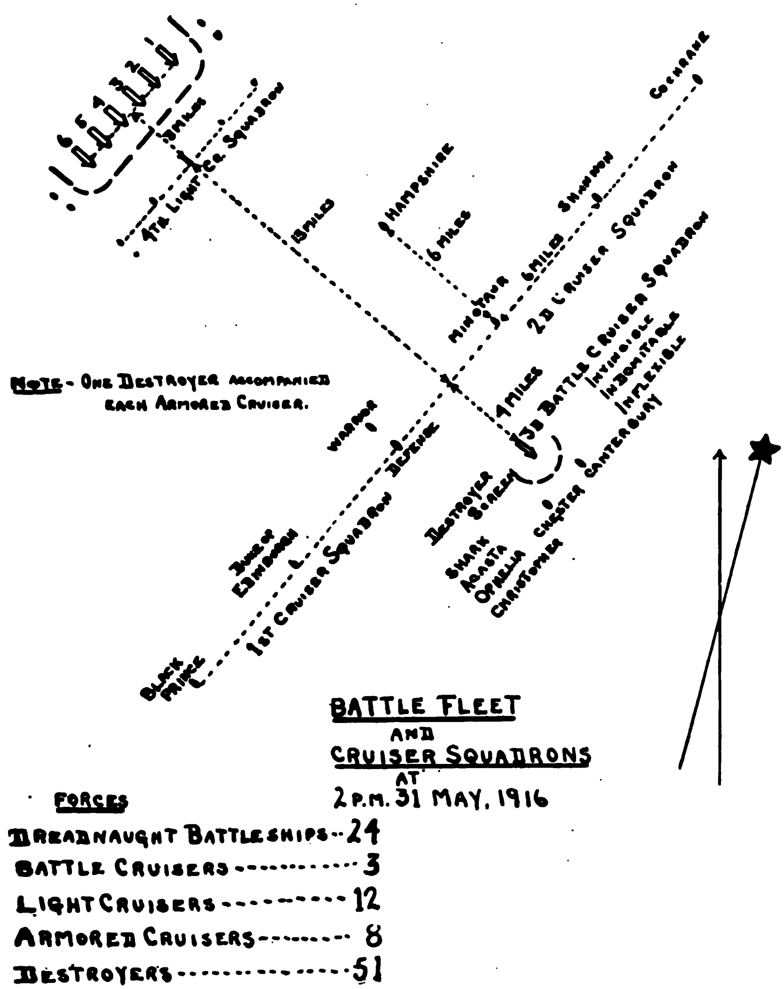

4TH LIGHT CR. SQUADRON
HAMPSHIRE
6 MILES
COCHRANE
SHANNON
2D CRUISER SQUADRON
MINOTAUR
3D BATTLE CRUISER SQUADRON
INVINCIBLE
INDOMITABLE
INFLEXIBLE
CANTERBURY
CHESTER
4 MILES
NOTE - ONE DESTROYER ACCOMPANIED EACH ARMORED CRUISER.
WARRIOR
DEFENSE
DUKE OF EDINBURGH
1ST CRUISER SQUADRON
BLACK PRINCE
DESTROYER SCREEN
SHARK
ACASTA
OPHELIA
CHRISTOPHER
BATTLE FLEET
AND
CRUISER SQUADRONS
AT
2 P.M. 31 MAY, 1916
FORCES
DREADNAUGHT BATTLESHIPS--24
BATTLE CRUISERS------------3
LIGHT CRUISERS----------12
ARMORED CRUISERS--------8
DESTROYERS---------------51

FIG. 3.

Eight miles, 144° true, from the *Lion* was a screen formed by the first, second and third light cruiser squadrons on a line of bearing 54° true. Two light cruisers were placed together at every interval of five miles. The formation of this screen was as follows, the western end of the line being at the left of the page:

DIRECTION OF ADVANCE

Second light cruiser squad.		Third light cruiser squad.		First light cruiser squad.	
Southampton	*Nottingham*	*Falmouth*	*Birkenhead*	*Inconstant*	*Galatea*
Birmingham	*Dublin*		*Gloucester*	*Cordelia*	*Phaeton*

The light cruiser *Yarmouth* of the third light cruiser squadron acted as linking ship between the screen and the *Lion*. The seaplane carrier *Engadine* was stationed between *Gloucester* and *Cordelia*. The flagships and flag officers of the light cruiser squadrons were as follows:

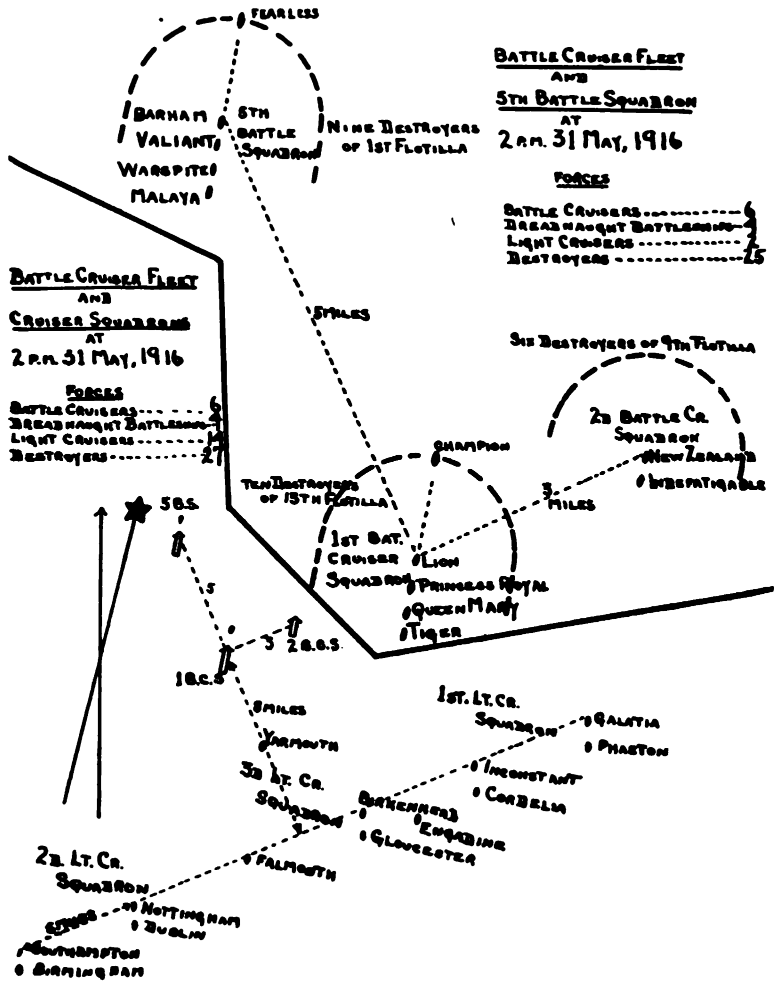
Flagship	Flag officer	Command
Southampton	Com. William E. Goodenough	Second light cruiser squadron.
Falmouth	Rear Adm. Trevylyan D. W. Napier	Third light cruiser squadron.
Galatea	Com. Edwyn S. Alexander-Sinclair	First light cruiser squadron.

All these forces were under the command of Vice Admiral Beatty; they had just turned to the northward and were steering a course 357° true at a speed of 19½ knots. The *Lion* was distant 77 miles from the *Iron Duke* at 2 p. m., but this distance was rapidly decreasing as the two parts of the Grand Fleet approached each other at high speeds.

At 2 p. m. Vice Admiral Hipper was proceeding on a course which was approximately north with the scouting force of the High Sea Fleet. He was in a position about 15 to 20 miles to the southeastward of Beatty, so that he shortly afterward made contact with the British light cruiser screen. Hipper commanded in person the first battle cruiser division composed of:

Lutzow (flag). *Derfflinger*. *Seydlitz*. *Moltke*. *Von der Tann*.

Four light cruisers of the second scouting group formed a scouting line to the northwest. Two destroyer flotillas were also present. While the normal German flotilla consisted of 11 boats, I assume that only 15 boats were actually present, as only this number participated in the massed destroyer attack at 4.15 p. m. I also assume that the light cruiser *Regensburg* was present in addition to the other four light cruisers and that it acted as the flagship for the two destroyer flotillas.



Fearless
Battle Cruiser Fleet
and
5th Battle Squadron
at
2 p.m. 31 May, 1916
Forces
Barham
Valiant
Warspite
Malaya
5th Battle Squadron
Nine Destroyers of 1st Flotilla
Battle Cruiser Fleet
and
Cruiser Squadrons
at
2 p.m. 31 May, 1916
Forces
5 miles
Six Destroyers of 9th Flotilla
2d Battle Cr. Squadron
New Zealand
Indefatigable
Champion
Ten Destroyers of 15th Flotilla
1st Bat. Cruiser Squadron
Lion
Princess Royal
Queen Mary
Tiger
5 miles
5 B.S.
2 B.S.
1 B.C.S.
5 miles
Yarmouth
1st Lt. Cr. Squadron
Galatea
Phaeton
Inconstant
Cordelia
3d Lt. Cr. Squadron
Birkenhead
Engadine
Gloucester
Falmouth
2d Lt. Cr. Squadron
Nottingham
Dublin
Southampton
Birmingham

Fig. 4.

About 50 miles to the southward of Hipper was the main body of the High Sea Fleet under the command of Vice Admiral Scheer. It was composed of three battle squadrons and was apparently in a long column of 22 ships. I regret that I do not know the order of the ships in formation. Their disposition was generally as follows:

Third battle squadron (eight dreadnought battleships).
Konig, flagship of Rear Admiral Behnecke, squadron commander.
Three ships of the *Konig* class.
Three ships of the *Kaiser* class.
Friedrich der Grosse, flagship of Vice Admiral Scheer, commander-in-chief.
First battle squadron (eight dreadnought battleships).
Four ships of the *Ostfriesland* class.
Three ships of the *Westfalen* class.
Westfalen, flagship of Rear Admiral Schmidt, squadron commander.
Second battle squadron (six pre-dreadnoughts), Rear Admiral Mauve.
Five ships of the *Deutschland* class.
One other pre-dreadnought.

The battle fleet was probably accompanied by the third and fourth scouting groups of four light cruisers each. There were probably 62 destroyers, led by two light cruisers, and the armored cruiser *Roon,* the only remaining vessel of that class in the German Navy.

The Grand Fleet was making one of its "periodical sweeps through the North Sea." It had left its bases on 30 May and up to 2 p. m. of the 31st nothing unusual had happened. It had no knowledge of the fact that German forces were at sea.

The mission of the High Sea Fleet is very difficult to determine, owing to the contradicting statements in the German official reports. One of these reports stated that the fleet went to sea with the intention of giving battle to the Grand Fleet; another, that it left to engage British forces reported off the Danish coast, while a third statement says that "there was no reason for supposing that any enemy forces were about, much less the entire British fleet."

The German mission was probably one of the following:

1. To make a practice cruise.
2. To strike a blow at the trade between England and Norway.
3. To attempt to cut off light British forces reported off the Danish coast.
4. To escort one or more raiders out to sea.

It seems certain that neither British nor Germans expected a contact between even battle cruisers, much less a contact between the two battle fleets.

IV. COMPARATIVE SPEEDS OF THE BRITISH AND GERMAN VESSELS

I regret to burden you with further statistics. However, you would find it difficult to understand the various moves made by the British and German commanders if you did not have a clear understanding of the comparative speeds of the various classes of British and German vessels. I therefore give you this information in tabular form. The "best recent speed" is taken from "Jane—1914."

BRITISH SHIPS OF THE SCOUTING FORCE

Name	Class	Designed speed	Best recent speed
Queen Mary	Battle cruiser	27	33
Tiger	Battle cruiser	27	32[1]
Lion	Battle cruiser	27	31.7
Princess Royal	Battle cruiser	28	32.4
Indefatigable	Battle cruiser	25	29.13
New Zealand	Battle cruiser	25	29[1]
Fifth battle squadron	Four battleships	25	25[1]

BRITISH SHIPS WITH THE MAIN BODY

Name	Class	Designed speed	Best recent speed
Invincible	Battle cruiser	25	28.6
Inflexible	Battle cruiser	25	28.4
Indomitable	Battle cruiser	25	28.7
Battle fleet	Twenty-four battleships	21	..

It is estimated that the battle fleet could make a maximum of 20 knots as a fleet; several divisions could make 22 knots and individual ships could probably make 23.

GERMAN SHIPS OF THE SCOUTING FORCE

Name	Class	Designed speed	Best recent speed
Lutzow	Battle cruiser	..	30[1]
Derfflinger	Battle cruiser	..	30[1]
Seydlitz	Battle cruiser	26.5	29
Moltke	Battle cruiser	27	28.4
Von der Tann	Battle cruiser	25	28.1

GERMAN SHIPS WITH THE MAIN BODY

Name	Class	Designed speed	Best recent speed
Konig class	Four battleships	21.	23[1]
Kaiser class	Four battleships	20.5	23
Ostfriesland class	Four battleships	20.5	22
Westfalen class	Four battleships	19.5	20.5
Deutschland class	Five pre-dreadnoughts	18	18[1]

[1] Estimated.

It is considered that the battle fleet could make a fleet speed of 17 knots; if the second battle squadron were left behind a fleet speed of 19 knots could probably be made.

From a glance at the table you will see that Beatty could fight with his entire force of 10 ships if he were content to steam at 25 knots; he could make 29 knots with six battle cruisers and 32 knots with his four best battle cruisers. I assume that the "best recent speeds" can be made for a short interval, due to the stimulus of battle.

On the other hand, Hipper could make 28 knots with his five battle cruisers. Therefore, if Beatty wished to fight with four ships to five—where he would be inferior in about the ratio of 9 to 10—he could gain at four knots speed. If he wished to fight with six ships to five—where he would be superior in about the ratio of 12 to 10—he could gain at the rate of one knot. If he wished to fight with 10 ships to five he would lose at the rate of three knots.

Now, consider the case of Scheer wishing to force an action on Beatty. If he wished to fight five battle cruisers against six British battle cruisers and four British battleships he could gain at the rate of three knots. If he wished to bring into action in addition his third battle squadron of eight battleships he would lose at the rate of two knots.

If Jellicoe wished to force Scheer to fight he could gain with 37 battleships and battle cruisers at the rate of three knots upon the German force of 21 battleships and battle cruisers and six pre-dreadnoughts. If Scheer left his pre-dreadnoughts to the mercy of the enemy, as Hipper was forced to do in the case of the *Blücher,* Jellicoe could still gain upon him at the rate of one knot.

Of course there is no way of telling just what each ship could make at the time of the Battle of Jutland and therefore you must consider all these figures approximately correct only. However, I believe that they are generally very close and that the conclusions given are substantially correct.

V. The First Contacts. 2.30 to 3.30 p.m. Position 1

At 2.20 the eastern vessel of the light cruiser screen, *Galatea,* flagship of Commodore Alexander-Sinclair, commanding the first light cruiser squadron, sighted two German light cruisers of the

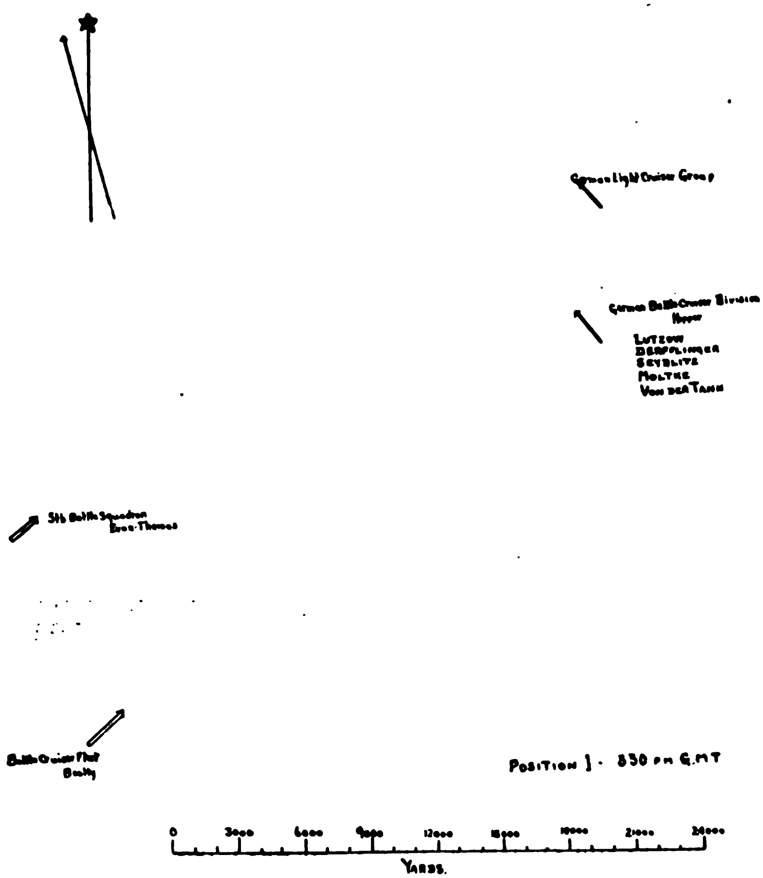

German Light Cruiser Group
German Battle Cruiser Division
Hipper
LUTZOW
DERFFLINGER
SEYDLITZ
MOLTKE
VON DER TANN
5th Battle Squadron
Evan-Thomas
Battle Cruiser Fleet
Beatty
POSITION 1 · 330 PM G.M.T
0
3000
6000
9000
12000
15000
18000
21000
24000
YARDS.

FIG. 5.

second scouting group bearing about 98° true. They were engaged in boarding a neutral steamer. Immediately upon receiving this information Beatty decided to steer for Horn Reefs Lightship in order to cut off the Germans from their base. He accordingly changed course with the battle cruiser fleet and the fifth battle squadron to 144° true. The first and third light cruiser squadrons spread to the eastward without orders and formed a screen in advance of the capital ships. The second light cruiser squadron concentrated and steered toward the *Lion* with the idea of taking up a position ahead of her.

At 2.30 Hipper received information from light cruisers of the second scouting group that about eight hostile light cruisers and 15 or 20 destroyers had been sighted to the westward. Hipper headed toward the British forces at high speed on a northwesterly course.

At 2.35 the *Galatea* reported a heavy smoke "as from a fleet" bearing 54° true and soon afterward reported that the enemy vessels were steering north. It was apparent from these reports that Beatty was between the enemy and his North Sea bases. His only opportunity for escape lay in a run through Skagerrak. He therefore headed toward the eastward and finally steadied on course 31° true.

At 2.45 Beatty directed the *Engadine* to send out a seaplane to search in the general direction of 8° true. At 3.08 the plane was off the water, the calm sea favoring her in taking off. At 3.30 the plane came under the fire of four light cruisers and reported their position.

At 3.30 the second light cruiser squadron took position ahead of the *Lion*, reporting that enemy battle cruisers were in sight bearing 54° true. By this time the second battle cruiser squadron, led by the *New Zealand*, had taken position astern of the first battle cruiser squadron, thus forming a column of six ships. The course was still 31° true and the speed was probably 20 knots.

The light cruisers of the first and third light cruiser squadrons engaged German light cruisers at long range and retired before the approach of the hostile battle cruisers, which continued on their northwesterly course.

Upon receiving the first radio reports from the *Galatea*, Admiral Jellicoe directed the battle fleet to raise steam for full speed. The cruisers and battle cruisers had steam up for full speed before the

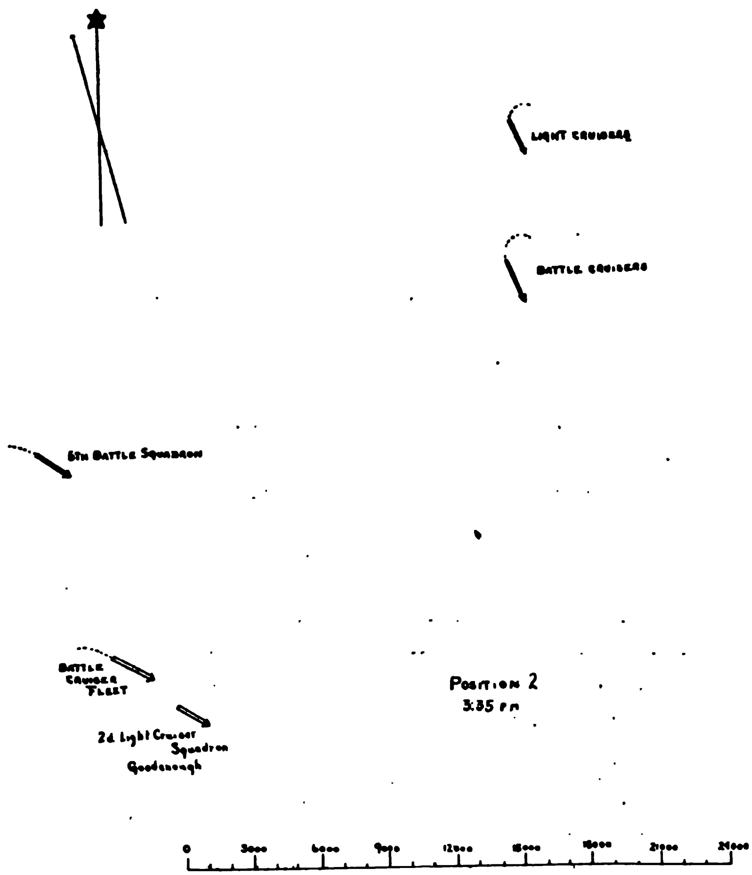

LIGHT CRUISERS
BATTLE CRUISERS
5TH BATTLE SQUADRON
BATTLE CRUISER FLEET
2d Light Cruiser Squadron Goodenough
POSITION 2
3.35 P.M.
0
3000
6000
9000
12000
15000
18000
21000
24000
YARDS

FIG. 6.

contacts. The third battle cruiser squadron was ordered to proceed to a position which would cut off the escape of the German forces into the Skagerrak. At 3.10 the battle fleet was ordered to prepare for action.

When the first reports of the sighting of hostile vessels were received from the German light cruisers Admiral Scheer increased the speed of the battle fleet.

VI. THE DEPLOYMENT. MOVE 2. 3.30 TO 3.35 P. M. POSITION 2

At 3.31 Beatty made out the German battle cruisers. He immediately increased speed to 25 knots and changed course to the right to 98° true; soon afterward course was changed to 122° true. The fifth battle squadron changed course at the same time and maintained its position 10,000 yards distant, bearing 352° true from the *Lion*. The second light cruiser squadron and the destroyers of the 9th and 13th flotillas were ahead of the battle cruiser fleet.

At 3.30 Hipper made out the British battle cruisers and changed course from about northwest (315° true) to about 158° true. It is probable that he turned toward the British, as this would bring him to his new course in the shortest time.

At 3.35 both forces had completed their deployments. Hipper bore about 45° true from Beatty, distant about 23,000 yards. Their courses were converging at an angle of about 45°. Admiral Beatty reports that at this time the visibility was good, that the sun was behind the British forces and that the wind was southeast. A little later the German official report describes the weather as follows: " The weather was clear and light and the sea was smooth with a northwest wind."

VII. THE APPROACH. MOVE 3. 3.35 TO 3.48 P. M. POSITION 3

At a little after 3.35 Beatty formed the battle cruiser fleet on a line of bearing so as to prevent smoke interference. The remainder of the British forces and all the German forces continued on their courses. The first and third light cruiser squadrons were concentrating on the battle cruiser fleet.

At 3.40 Admiral Jellicoe received a report from Beatty that he had sighted five battle cruisers and a number of destroyers. Immediately the course of the battle fleet was changed to 132° true in order to close the battle cruiser fleet and speed was increased as rapidly as possible.

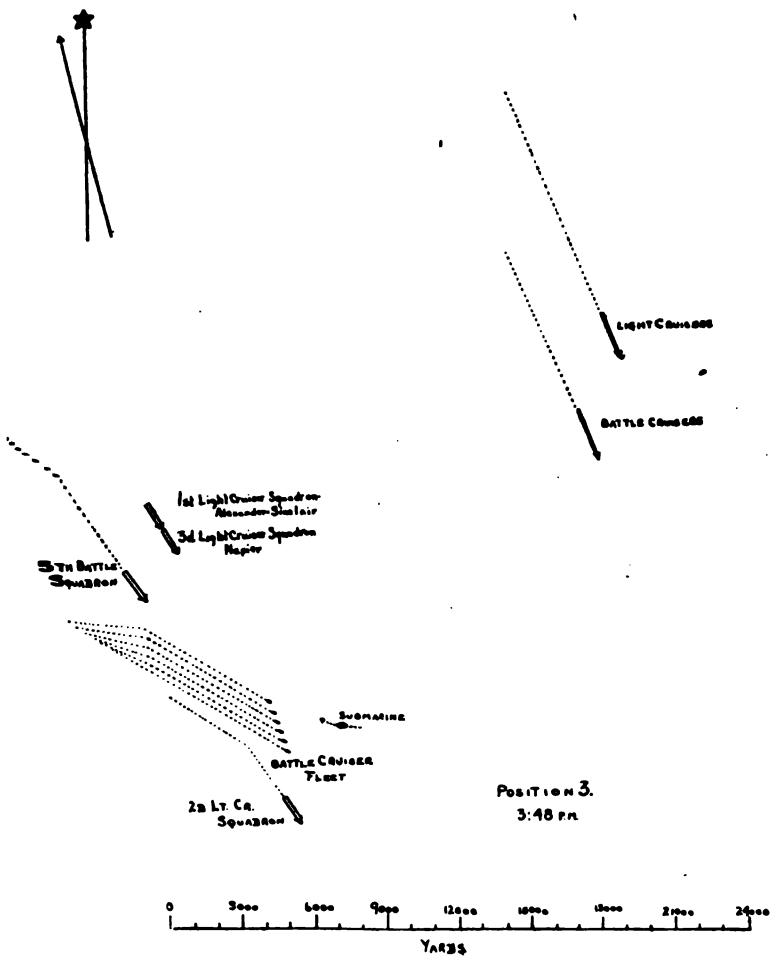

Light Cruisers
Battle Cruisers
1st Light Cruiser Squadron
Alexander-Sinclair
3d Light Cruiser Squadron
Napier
5th Battle Squadron
Submarine
Battle Cruiser Fleet
2d Lt. Cr. Squadron
Position 3.
3:48 P.M.
0
3000
6000
9000
12000
24000
Yards

FIG. 7.

In order that you may understand the results of the action which was fought between Beatty and Hipper, I ask you to glance over the characteristics of the opposing forces:

BATTLE CRUISER FLEET

Name	Armor	Displace-ment	Guns
Queen Mary	9"	26,350	8 13.5"
Lion	9"	26,350	8 13.5"
Tiger	9"	28,500	8 13.5"
Princess Royal	9"	28,350	8 13.5"
Indefatigable	8"	18,800	8 12"
New Zealand	8"	18,800	8 12"
		145,150	

FIRST CRUISER DIVISION

Name	Armor	Displace-ment	Guns
Lutzow	13" ?	26,180	8 12"
Derfflinger	13" ?	26,180	8 12"
Seydlitz	11"	24,610	10 11"
Moltke	11"	22,640	10 11"
Von der Tann	10"	19,100	8 11"
		118,710	

You will note that the Germans had a great superiority in armor and that the British had an equally great superiority in guns. The displacements give the fairest test, and they show that the British were superior in about the ratio of 6 to 5, but Beatty had in addition the four fine battleships of the fifth battle squadron. These were certainly the finest ships afloat. They displaced 27,500 tons, carried eight 15-inch guns, had side armor of 13 inches and could make 25 knots. If these ships could enter the action, Beatty would have a superiority well in excess of 2 to 1.

At 3.45 a torpedo from a submarine passed through the battle cruiser line.

(TO BE CONTINUED)

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE FREEDOM OF THE SEAS[1]

By Admiral Sir Reginald Custance, R. N., G. C. B.

When the secretary to the society did me the honor to suggest reading a paper on the *Freedom of the Seas*, I was reluctant to do so until it occurred to me that it might be useful to set forth its military aspect. The wishes of the society will perhaps be met by an argument, based as far as possible, on the military side of the question and by reference only to the legal side where necessary to lucidity.

It is generally accepted that under normal conditions in time of peace the high seas are, and have been for some years, entirely free to those who pass upon their lawful occasions. As is well known this freedom is impaired on the outbreak of war. A full understanding of the reason for this change cannot be reached without a correct knowledge of the principles underlying the conduct of war. These may be briefly summarized.

It will be admitted that the difference between peace and war is that in lieu of argument to persuade, each side uses physical force to compel the other to yield to his will. Furthermore, the acts of all great commanders and the arguments of writers of acknowledged authority have shown that the decisive act in war is the fight or battle, and the decisive factor the armed force which alone takes direct part in the decisive act. The reciprocal primary military aim is, therefore, to destroy the armed force by battle, or, as that cannot usually be done by one instantaneous blow, to neutralize its action by the threat of battle or by a series of small blows during the interval of waiting. Second only to that aim is the need to impair the efficiency of the armed force, and thus to prepare its destruction by sapping the resources upon which it depends. The action taken to effect this is the same in principle whether ashore

[1] Read before the Grotius Society 15 July, 1919. A British Point of View.

or afloat. After the armed force has been defeated or neutralized, the victor or stronger side, on land overruns completely or partially the territory of the vanquished or weaker side, deprives him of its resources, and utilizes them himself, as did the Germans in Belgium, Northern France and Roumania during the late war.

Similarly at sea, movement on the ocean is more or less free to the stronger side, but is completely or partially denied to the weaker. Unarmed ships as potential instruments of war are seized and used by the captor. Supplies from the outside world can be imported by the stronger side, but are completely or partially cut off from the weaker. These supplies from abroad are sometimes very important, since they are often required to complete the food, clothing, armament and equipment of the armed forces and the food and clothing of the unarmed population, which by production and supply sustains the fighting man and thus plays an important part in carrying on the war, as was seen during the late war.

Moreover, the profits derived from handling the trade, especially that seaborne, are sometimes very large and may provide much of the wealth required to finance a war, as actually occurred in the case of Great Britain during the great French war. It will be seen that any stoppage of these supplies to a belligerent tends to reduce directly his armed strength by land and sea, and to impair indirectly the spirit and morale of both his armed force and his unarmed population. As a large proportion of these supplies is usually seaborne, the stoppage of sea trade cannot be looked upon as otherwise than an essential operation of war, since it prepares success in the decisive battle on land and sea, and thus tends to shorten the war. We have constantly to bear in mind that the interdependence between land and sea is close, although not always plainly seen; also that the reaction of the land operations on those at sea, *i. e.* of the land battle on the sea battle, and vice versa may be prolonged in time, but is always working during the war; also that as the land battle and the sea battle are dependent activities the double decision by land and sea or its equivalent is necessary. Furthermore, since the greater contains the less, stoppage of sea trade is also a legitimate means of coercion as a substitute for war in time of peace.

Now, sea trade is stopped by capture and by the threat of capture, which has for several generations been specifically recognized by the law of nations as a legitimate operation of war probably for

the reasons above set forth—either explicitly stated as in the case of contraband or implicitly accepted as in that of enemy goods. Furthermore, it is common knowledge that the losses due to actual capture are small compared with those due to the stoppage of trade and therefore the value of the prizes is of relatively small importance. Whatever may have been the case in the past this right of capture is claimed and exercised now as a means to weaken the enemy's armed force and to shorten the war. To resign or to weaken that right of capture is to throw extra stress on the fighting men on land and on sea, and ultimately on the nation. Under modern conditions, when whole nations take part directly or indirectly in the fighting, this extra stress may become very great.

As is well known, attempts to weaken the right of capture have been made at intervals from the 18th century onwards. The principal argument used has been that ships and cargoes are private property and that their capture is a hardship on private individuals. The argument has no real foundation, since for several generations both ships and cargoes have been insured with the result that the losses and the cost of insurance are borne by the whole body of consumers, who pay increased prices to cover them. Is there not some truth underlying the layman's remark that: "Seemingly the only safe place for belligerent private property is at sea."

Again, exception has been taken to the right to capture property on the ground that a different practice is followed on land. The most important difference is that the military commander is a law to himself, whereas, the proceedings of the naval commander are reviewed by a prize court. The former acts outside the law, the latter under the law. Attention is invited to the difference between the proceedings before the British prize court and those followed by Napoleon's marshals during the great French war and by the German generals during the war just ended. These are well known to you and need not be set forth in detail.

That maritime capture is humane when carried out under the rules recognized by international law is evident from the procedure established under them and by the practice of the past. The duty of the captor was then to bring in, for adjudication by a prize court, any merchant ship he detained. If the ship captured was an enemy, the rule was not always observed. The United

States made a practice of destroying enemy prizes in the war of 1812, but the British and French rule was always to bring them in, if possible. Whether the ship was brought in or not, the safety of the *personnel* was always secure, and the captor had to justify his proceedings before a prize court. He always acted under the law and was liable for costs and damages, if he took a ship without probable cause. The great change introduced by Germany in conducting the recent war consists in making war at sea inhumane in that the lives of both crew and passengers have been deliberately risked and sacrificed. She aimed at making war at sea as ruthless, brutal and lawless as it too often has been on land. The wisdom of calling upon the captor to justify his proceedings before a prize court cannot be doubted. The decision of the Paris conference seems to extend the principle and to apply it to those who break the law of nations, not only to those who sink ships without warning and thus risk the lives of passengers and crews, but to those who issue the orders to do so.

Again, sea trade is carried on ships, of which some belong to belligerents and others to neutrals, as also their cargoes. Hence neutral interests are affected, and many disputes arise about the rules relating to blockades, contraband, continuous voyage, etc., by which the trade of neutrals with belligerents is regulated and the inconvenience and loss to neutrals in some respects mitigated. In these disputes the immediate interest of the belligerent is complete stoppage of trade, while that of the neutral may seem to be its continuance uninterrupted although the reverse is often the case, as in the late great German war, when the general security and the reign of law were menaced.

Usually each side is held back from making extreme demands by action either already taken in the past or possibly required in the future when the parts are reversed. Moreover, the political object of the war, the many sided friction in the political and international machines, the relative strengths not only of the belligerents but of the neutrals, and the progress of the war all tend to influence the relations between belligerents and neutrals and the action respectively taken by them. In fact, the stoppage of neutral trade with a belligerent has always been dependent upon action taken by the belligerents and either accepted or tolerated by neutrals, or so much opposed by them that they have ultimately joined in the war. On the other hand, trade between

neutrals entirely clear of any belligerent taint has usually been free in time of war, except that neutral ships have been liable "to visit and search."

The existing practice having been thus sketched we turn to the second point in President Wilson's peace program, which reads:

> II. Absolute freedom of navigation upon the seas, outside territorial waters, alike in peace and war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.

The allied governments took exception to this clause as being "open to various interpretations, some of which they could not accept." As some justification for this caution it may be remarked that absolute freedom of navigation upon the seas, outside territorial waters, in war seems to mean peace at sea and war on land, as otherwise there will be no war at all. War at sea will only begin when international action is taken. Thus, war at sea is to be limited by international action, but war on land is to remain unlimited. This result tends to undermine the principle that action by land and sea is interdependent. Again, it is to be specially noted that President Wilson accepts the long-established practice that the seas may be closed in whole or in part, but by international, instead of national, action and only to enforce international covenants. Everything will depend upon whether international action, in a righteous cause, can be made as rapid and efficient as that of a belligerent nation or group of nations fettered by friction with neutrals—an important point, seeing that upon it may depend the security of Great Britain and other countries.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MINING OPERATIONS IN THE WAR

By Lieut. Commander Norman Van der Veer, U. S. Navy

From the very beginning of the war, Germany adopted a policy, and vigorously pursued a campaign of minelaying in the vicinity of the English coast; apparently she lost no opportunity of laying floating mines, where the water is too deep for anchorage, and fields of anchored mines in shoal water. To this policy, together with her universal reliance on the submarine, may be credited many of her successes, while England had recourse principally to gunfire. In the event of a decisive engagement in the North Sea these methods might easily have had a more far-reaching effect than is, at first glance, apparent. Certain it is that they caused the British fleet to concentrate at various bases on the coast of England and Scotland, where it, in turn, was thoroughly protected by mine-fields. And this widespread use of the mine has had another effect, in that it has served to create and develop that miniature navy, the trawler arm of the Grand Fleet. All along the coast of Great Britain these small craft gathered in surprisingly large numbers; in one port alone, over a thousand trawlers have been fitted out, and, it is said over 12,000 men were required in this branch of the service.

In the war mines were used for two distinct purposes: (1) To close military ports; (2) As a distinct operation against a hostile fleet or ship. The object of these uses requires no explanation. But, in addition to these recognized uses, mines have also been used in connection with no definite military scheme. The Germans seem to have scattered them on the chance of destroying individual men-of-war or merchant vessels of the enemy. An article of the Hague conference forbids the laying of automatic contact mines off the coast of the enemy with the sole purpose of intercepting commercial shipping. Germany signed this article "with reservation;" and this paper is not concerned with the situation from

the standpoint of international law, except, in passing, to invite attention to the fact that, as a result of serious damage to neutral shipping, we, in our note of February 22, 1915, suggested that "isolated drifting mines should be laid by neither party, that anchored mines should be laid exclusively for defensive purposes within range of harbors, to become harmless after breaking loose from their anchorages."

Considering first the laying of the mines for the purpose of closing military ports, and the effect thereof on naval strategy and tactics, reliable sources indicate that, during the latter part of the war, the following was the situation in regard to the ports of the North Sea.

Early in the war British submarines succeeded in entering the harbor of Kiel, only, as might have been anticipated, to find the German fleet protected by many minefields. Cuxhaven was heavily mined, as well as the mouths of the Weser, Jahde and Elbe, the mouths of the Scheldt and the approaches to Antwerp, the waters around Borkum, and, of course, Helgoland. There was no opportunity for these minefields to cause any actual damage to the British fleet. On the contrary, they proved to be a source of danger to the Germans themselves. For we read of a German patrol boat striking three mines near Borkum; and, pursuant to striking a chain of mines that blocked the entrance to Jahde Bay, the cruiser *Yorck* was totally destroyed, a tragedy that resulted in the sentencing of her commander to two years' detention in a fortress as a penalty for his negligence.

But even though these minefields in the vicinity of German ports caused no direct damage to the British, their strategical and tactical value has been vast. After the injuries to the *Lion* resulted in the temporary withdrawal of Sir David Beatty from the Dogger Bank engagement, the British fleet gave up the chase and countermarched at a distance of about fifty miles from Helgoland. The first English report of the battle states that the reason for abandoning the pursuit was due to the danger of running into minefields. In confirmation of this, there is the German report that Von Hipper, shortly after sighting the British squadron, some 120 miles from Helgoland, changed course to the southeast in order to draw the enemy toward the minefields. The mooted question as to whether the British would have turned back had Sir David Beatty been able to hold his place in formation does not now con-

cern us. The fact remains that the abandonment of the pursuit presumably because of the danger from mines may, as one writer has aptly pointed out, have robbed the British of a complete victory "in the Nelsonian sense."

Early in the war, the British Admiralty, as a result of the great activity of the Germans in minelaying, developed, on a considerable scale, an aggressive policy in this form of war on the sea. To reduce the risk to non-combatants, the Admiralty announced the parallels and meridians bounding a rectangle in the North Sea which was to be considered as a danger area, supplementing the notification with the caution: "Although these limits are assigned to the danger area, it must not be supposed that navigation is safe in any part of the southern waters of the North Sea. Instructions have been issued to His Majesty's ships to warn east-going vessels of the presence of minefields." In May, 1916, it was deemed advisable to extend the eastern and southern limits of the danger area and to publish the new limiting parallel and meridian.

In October 1914 the battleship *Audacious* sank after striking a mine off the North Irish coast, presumably while seeking suitable waters in which to hold her great gun practice. Shortly after this disaster neutral vessels were warned of the presence of mines off the north coast of Ireland, and there was set out in the North Channel a danger area the limits of which were made public. The purpose of this move was to close the greater portion of the North Channel, leading from the Atlantic into the Irish Sea. The parallelogram limiting this danger area occupied the north part of the channel, leaving a narrow passage between it and the Irish coast. This passage was to be used only in daytime, and no ship was to be within four miles of Rathlin Island between sunset and sunrise. This rendered it a simple proposition to examine vessels entering the Irish Sea from the westward, and made it extremely difficult for enemy minelayers to operate. It is also probable that this step had the effect of diverting the greater part of Atlantic traffic around the south of Ireland, where, owing to more sea room, there are greater facilities for maneuvering to avoid the attack of submarines.

In the Baltic, Germany originally conceived the project of forcing an entrance to Riga and landing an expeditionary force to co-operate with the left wing of her army. This she was unable to accomplish because of the well guarded minefields at the

entrance of the gulf. In addition to Riga, the coast waters of the Aland archipelago and the entrances and exits of the Gulf of Finland were heavily mined. The existence of minefields in international waters south of the Danish island of Saltholm, off the Drogeden lightship, along Falsterbo Reef, and near the approaches to Stockholm caused no little anxiety to the powers of Norway, Sweden and Denmark, striving as they were alike to protect the interests of neutrals and to avoid giving offence to either belligerent.

In the Asiatic, German minefields in Kiaochou Bay prolonged the defence of Tsingtau against the British and Japanese squadrons and effected the loss of the Japanese cruiser *Takachiko* and several torpedo boats. From a plan obtained after the capitulation, it is known that Germany had planted at least 300 mines in the harbor of Laoshan.

Perhaps of all the theaters of the war, the Dardanelles lent themselves most favorably to the use of the mine. It was possible to render this whole area impassable by the use of the three recognized types—contact, observation and floating. While the velocity of the current offered certain difficulties to the use of the contact type, the narrowness of the channel facilitated the use of the complicated device necessary to explode observation mines from the shore; and the constant danger from floating mines drifting down with the current from the sea of Marmora was one against which it was necessary to maintain eternal vigilance. It is known that contact mines, to the number of forty, were laid in double line from Kephez to Suandère. Yet all precautions taken by the Germans in the Dardanelles did not entirely suffice; witness the brilliant exploit of Lieutenant Holbrock, who, despite the difficult current, ran his submarine into the Dardanelles, dived under five rows of mines, and sank the Turkish battleship *Messudiyeh,* which was guarding the field.

Early in the war the port of Bourgas in the Black Sea was closed. Varna could be entered in daytime only, and vessels were forced to stop at Kamtchia and wait for a pilot.

The enemy mined the bay of Cattaro in the Adriatic. British and French torpedo-boats, dragging the bay, recovered more than 1000 mines; and the French destroyer *Dague* was blown up while dragging off Antivari.

To illustrate the second use of the mine—as a distinct operation against a hostile fleet or ship—there is, early in the war, the engagement that resulted in the mutual destruction of the *Koningen Luise* and the *Amphion*. The *Koningen Luise* was a Hamburg Amerika passenger vessel which had been converted into a minelayer. After she had probably laid a line of mines from Aldebrugh ridge to the northeast, she was sighted about sixty miles off the coast of Suffolk by the British light cruiser *Amphion*. The minelayer was pursued for 30 miles, overhauled and sunk. After picking up the survivors, the *Amphion*, on her return to port, when nearing the scene of the minelayer's operations, altered course to avoid the supposed danger; however, despite this precaution, she struck two mines and sank.

Subsequent to the light engagement in the North Sea that occurred during the first month of the war, Sir David Beatty reported to the Admiralty: "Our destroyers reported the presence of floating mines to the eastward, and I considered it inadvisable to pursue her." It is probable that the "two-funneled cruiser" the *Lion* was then pursuing had saved herself by launching floating mines.

The destruction of the battleship *Formidable* in the channel was due to a floating mine or to a submarine. And the loss of the *King Edward VII.* was presumably due to her striking a mine in the North Sea, off Spurn Head; the German Admiralty, in fact, attributed the credit of the destruction of this vessel to the mysterious commerce destroyer *Moewe*.

Especially in the Dardanelles has there been ample opportunity for the use of floating mines against a hostile fleet. Utilizing to the very fullest extent the strong current that sets from the Sea of Marmora to the Mediterranean, the Turks employed the floating mine after the fashion of a torpedo. And it is to this weapon that the loss of the battleships *Irresistible, Ocean,* and *Bouvet,* and the injury to the battle cruiser *Inflexible* have been attributed. Also the destruction of the battleship *Russell* in the Mediterranean was probably due to the explosion of a mine.

In addition to carrying out vigorously the policies hitherto recognized in regard to the use of the mine, the Germans inaugurated and pursued more aggressive measures. Making use without doubt of their submarine minelayers, they pushed their campaign to points surprisingly near the British coast. Neutral and

enemy vessels have been destroyed off the mouth of the Tyne, many of them within sight of Newcastle and Dover. The *Audacious* met her fate due to striking a minefield that the enemy had laid off the Irish coast. In fact, the British Admiralty issued warnings to the effect that neutral shipping was endangered by mines in this vicinity, thus admitting that German activities in this direction had extended even to the coast of Ireland. Mention has already been made of the counter measures adopted by England in the North Sea, the English Channel and the North Channel pursuant to Germany's vigorous campaign.

To say nothing of the loss of a host of smaller vessels, the destruction of the battleships *Audacious, Irresistible, Bouvet, Ocean, Formidable, Russell,* and *King Edward VII.*, is a large toll exacted of the allies as a result of mining operations. Nor should we overlook the destruction of the *Hampshire,* with the death of Lord Kitchener, and the incalculable loss to England that ensued therefrom.

As to the character of the mines used, it has been pointed out that they have been of the observation, the contact and the floating types.

In regard to the mechanical features of these mines there is, of course, but little available that is not confidential. But it is of interest to note the elementary details of a mine used largely by the Turks in the Dardanelles, called the Leon torpedo mine. This mine, invented by a Swedish officer, Captain Karl Leon, may be launched simply by placing it in the water, or by ejecting it in the same manner as the ordinary torpedo. Cylindrical in shape, the mine is divided into two separate compartments; the upper contains the explosive, together with the firing apparatus in a central tube; the lower compartment is itself divided into two sections, the upper of which contains a battery of accumulators, and the lower the machinery. Weights are arranged so that the mine, when submerged, retains a vertical position. This is accomplished by means of a chamber that fills with water, thus giving the mine a tendency to sink. The speed at which this chamber fills, and hence the rate at which the mine sinks is controlled by a valve. Even with a full reservoir, the mine is only slightly heavier than water, so that it never sinks rapidly. When a certain depth has been reached, the pressure of the outside water acts on a hydrostat which is arranged to close a switch connecting the

battery to a motor which drives the mine propeller. The mine then commences to rise. When a point within five feet of the surface has been reached, in consequence of the reduced pressure on the hydrostat, the battery switch opens, the motor stops and the mine sinks. It is possible to adjust the hydrostat so that the maximum immersion may be obtained within limits of five to ten feet from the surface. A clock device may be set to limit the length of time within which the mine is to remain active. This control is accomplished by interrupting the current at the end of the time set. The clock device may likewise be used to delay the time at which the mine is to become active. In the latter case, the mine remains at the bottom until, at the expiration of the time designated, the motor switch is closed and the propeller functions. A stabilizer is fitted in order to compensate for different densities of water.

The Leon mine may be used as a distinct operation against a hostile fleet or ship, or in the attack on a tidal port. For the latter purpose, mines are launched when the tide is flowing, and travel with the ingoing water. Where a long estuary is to be traversed, the clockwork is arranged to function after a given interval; when the tide ebbs, the mine sinks, to rise again when the flood renews. It is also possible so to arrange the mechanism that the battery is connected with the motor only at the end of a given period; when so adjusted, the mine finally comes to the surface and remains there until the battery runs down.

For the purpose of minelaying, all sorts and conditions of vessels were pressed into service. They ranged from converted destroyers and passenger steamers to the German submarine minelayers.

The French found very valuable three vessels of the *Casabianca* class. Originally built for destroyers, with a displacement of 950 tons, they proved to be too slow for this service. Accordingly, they were converted into minelayers, a process that raised their tonnage to 1020, and still further reduced their speed. Each of these vessels carried about 100 mines. The *Casabianca* was destroyed by one of her own mines while engaged in hazardous night work in the Aegean, but her sister ships, the *Cassini* and the *d'Iberville* rendered very valuable service. Later types of French minelayers were smaller in displacement—566 tons—but they carried 120 mines weighing 550 kilos each. Of this type were the *Pluton* and the *Cerbère*.

The German minelayer *Königin Luise* was a passenger steamer of 2200 tons, while the Russians successfully used vessels as large as the *Prout,* of 5000 tons, with a capacity of 700 mines.

For months after the outbreak of the war, there was great perplexity over the facility with which the Germans were able to plant mines within short distances of the English coast, and the British press was rife with statements to the effect that these mines had been laid by " pleasure steamers and fishing smacks," vessels flying neutral flags and merchantmen. In spite, however, of the vigilance of the British patrol, it does not appear that a single vessel of this description was actually captured or sunk while in the act of sowing mines while flying a neutral flag. It would therefore seem appropriate to attribute the greater part of this mineplanting to the activities of submarine minelayers which, it is now evident, Germany used for some time. The capture of the submarine minelayer *UC-5* cleared the mystery. This little vessel—the first of her kind captured— was 100 feet in length; she had a beam of 10 feet, 6 inches, and drew 11 feet when awash; she was propelled by a six cylinder Deisel engine of 250-horsepower. According to one of her crew—her complement was five officers and 13 men—she had made 19 trips from Germany to the British coast; on her 20th she was captured by a British patrol vessel. It is said that in the course of her various trips she laid over 200 mines in routes frequented by merchant vessels. The *UC-5,* one of the forerunners of a numerous class—was constructed in four sections. On top of the hull was a light superstructure of thin plating to make a level deck. Conning-tower, periscope and wireless mast were placed amidships. The entire hull forward of the conning-tower was a mine-carrying case. Countersunk in the deck was a row of six gratings; beneath each grating a steel chute slanted from top to bottom. This steel tube was fitted with flanged runners on which slide four stays holding the mines, of which each chute contained two. The mines were released by the operation of a lever fitted inside the hull. Once released, the mine sank to the bottom; then angle irons surrounding it were automatically released at the top, and, dropping outward and downward, lay on the bottom to form a rest for the mine. The anchor remained on the bottom, while the mine itself rises, hauling after it a steel wire which unwinds from a drum revolving within

the anchor. A hydrostatic valve was fitted to determine the depth at which the mine was to float below the surface.

Countermining operations took the usual forms of dragging, sweeping and detonating. There is little available data in regard to the last named method. Electricity has probably been used for this purpose; and many mines have been exploded by gunfire in the English Channel and off the coast of Antivari.

For the purpose of dragging and sweeping, torpedo-boats and destroyers have been especially valuable. In the Adriatic, sweeping operations by allied torpedo-boats resulted in the recovery of over 1000 mines in the Bay of Cattaro alone. The Germans effected their one entrance to the Gulf of Riga after several days of difficult mine-sweeping. British and French destroyers rendered especially valuable service in the Dardanelles. The entrance to Laoshan Bay was patrolled by sweeping destroyers with the assistance of trawlers and patrol boats; and several Japanese destroyers were blown up in the course of the operations.

Finally, the fleet of trawlers rendered inestimable service in mine-sweeping operations. It has been pointed out that this arm of the British fleet has attained astounding proportions; it is a veritable mosquito fleet in itself. Following raids on Scarborough and Hartlepool, over 1500 mines were picked up by trawlers in one week. In the course of work of this nature many boats were lost; frequently mines exploded in the nets. In addition to their value in work of this nature, it is claimed that there is no better protection for a battleship at anchor than a surrounding cordon of trawlers when danger from mines or submarines is apprehended. England has thoroughly demonstrated the value of the trawler fleet. Let us bear in mind that, if the time ever comes to require its service, it would be well for us to have ready to our hand a defensive weapon of such magnitude and efficiency.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE STUDY OF NAVAL HISTORY

By Associate Professor H. J. Fenton, U. S. Naval Academy

Mahan says that the study of history is not theoretical but practical because it ends, not in speculation, but in action. If this be true of history in general, it must be peculiarly so of military history since the greater must always include the less, but still more so because no department of history is so likely to stir the imagination and to fill the soul with enthusiasm as that which deals with military operations.

But it is doubtful if all of us get quite this result from our gropings in history, although we may cover the field from Thucydides to Mahan, because we pay too much attention to the bare facts of history and ponder too little the suggestions. To many of us a military operation means so many objectives lost or taken, so many killed or wounded, somebody raised to the pinnacle of fame by victory, or somebody tumbled to oblivion by defeat. These little facts we tuck away in our minds like letters in a drawer, thinking that somehow or some day they will be of use to us. But what avails it to know that Napoleon was defeated at Waterloo if that is all there is to it? What avails it to know that hundreds died in one battle and thousands in another unless we sense and ponder the causes for which they gave their measure of devotion? Of what use is it to read that Nelson at Trafalgar shattered the power of Napoleon on the sea, unless reflection thereon creates in the reader a greater power for individual action?

"The greatest inspiration of my life," said Napoleon, "was a memory." Memory of what? Memory of battle tactics in some long past conflict, or lists of the dead or captured, or the names of the kings and queens, or the political or battle leaders of yesterday? Perhaps so, but I rather think it was the memory of some energetic action done or deed of heroism performed, or of someone—it may have been a general or a private—whose instant decision in a tremendous crisis changed the course of history. I would not in this connection belittle the knowledge of names and dates or of the movements of fleets and armies. These facts have their

value, but it is not supreme. They are useful items for mental lucubrations or for vigorous argument or conversation. But unless somehow they end in action on our part they are theoretical rather than practical. It is in the reaction of historical facts on us that their chief value lies.

From a somewhat lengthy experience in listening to midshipmen recite their lessons in naval history I should say that it is a rare student indeed who sees beyond the bare fact to the lesson or suggestion which the fact might convey to him. Naval history to the majority of students—and is not this true of too many of us who have passed beyond the schoolboy stage?—is theoretical because it ends in recitation or the mere reading. This is more or less true of almost any chapter in naval history that might be selected, but I am thinking in this connection of that fine old battle in the West Indies when Rodney beat De Grasse and in a moment of vigorous action shattered the traditions of a hundred years. What does the casual reader remember of that engagement? Mainly, besides the names of a few ships and a few ship commanders, the fact that the British admiral by a new maneuver broke up the French line of battle and won a great victory. But why should one strive to remember that fact? Is one any better off for memorizing it than he was before? Is a naval officer any better strategist or tactician or a more effective personality for having merely *read* an account of the battle of the Saints' Passage? I doubt it, unless Rodney's acts mean more to him than naval histories usually express. It is, however, the function of history mainly to tabulate and faithfully record; it is for the reader himself to scrutinize the facts as presented, to reflect and to feel their deeper significance, and every important action in the past has a meaning to the present beyond the mere statement, else it is as valueless as an unrelated date or a proper name. So it is, or should be, with the work of Rodney at the Saints' Passage. As a bit of by-gone tactics it is of no great value to-day, but as a lesson in personal courage, instant decision, and responsibility it is tremendous.

What was the situation? The majority of the readers of the PROCEEDINGS are perfectly familiar with it. Two great fleets were passing each other on opposite courses and at fairly close range, according to the gentlemanly way of conducting naval actions in the olden days. If nothing untoward had happened the two fleets would have passed each other completely, countermarched perhaps

and passed again, and yet again, or until each had been pummeled enough to cause it to be willing to retire with honors even, or until one had withdrawn with the other after it in an attempt to capture either it or stragglers from it. Owing, however, to the erratic action of the light wind a gap suddenly opened in the French line directly opposite to the English flagship, offering to Rodney the chance of a lifetime. But to seize the opportunity thus presented for concentration and for destroying the enemy in detail, meant to break his own orders still flying at the masthead, the "Fighting Instructions" of the British Admiralty, and a hundred years of tradition, which was perhaps as bad. Opportunity said, "Go." Everything else said: "Obey orders, maintain the line, hold fast to tradition."

It was no light thing in those days to obey the voice of opportunity. Originality and initiative were not encouraged then in the British Navy. To deviate from the "Fighting Instructions" meant a court-martial trial with the odds in favor of the court. To break tradition and after all to fail, meant ignominy and almost certain execution. The fate of Byng, it may be, flashed through Rodney's mind in that moment of destiny. A more commonplace officer at such a time, especially if advanced in years, would have played safe; he would have stuck to tradition, he would have maintained his line, and the battle of the Saints' Passage would have meant little or nothing to future generations. But Rodney was above the commonplace, or else he did in a moment of fine frenzy what he might not have done in a time of less excitement. Casting tradition, precedent, "Fighting Instructions," and all such hindrances to initiative by the board, he swept into the tempting gap and turned a dubious contest into a tremendous victory.

Such, in brief, was Rodney's operation at the Saints' Passage. Regarded as a mere episode it is striking enough, but when studied in its proper relation to the preceding events its reaction on the reader should be still greater. The battle was not an isolated engagement, but the culmination of a long campaign pursued with persistence but marked by no particular brilliance, no dashing action calculated to set one's blood afire. It had been a military game of hide and seek, of pursuit and escape, of long-range duels from which came no very satisfying results. Against this rather dull background Rodney's action shines with peculiar luster. It is said that there are moments in the lives of men—and is it not more so of military men?—big with destiny. If so, then ac-

cording as men have acquired the power of quick decision and the willingness to assume responsibility they have enshrined themselves in the pages of written history. Such a moment was Rodney's at the Saints' Passage, such was Farragut's at Mobile Bay, and such was Dewey's at Manila when he invited almost certain war with one of the greatest of European naval powers by an open display of American spunk. So it might be possible to continue and enumerate a long list of other such instances where the personal element was everything, instances perpetually reminding the reader that he too can make his life sublime.

Such actions on the part of men cannot be told too well or pondered too much, and it is a dull reader that, after perusing them, does not feel as never before the great value of initiative, of dash, and above all the willingness to assume the burden of responsibility. Naval history, therefore, should be studied quite as much, perhaps more so, for the personal inspiration as for the knowledge of the sequence of related facts or events. If one's reading of history, then, be it of naval operation or political movement, produces no mental stimulus or spiritual reaction, I say he has read in vain; he had better re-read, and in reading, reflect. There is such a thing as a philosophy of history, a philosophy of sea power, and it ought to be the aim of every historian to suggest it, of every teacher of history to expound it, and of every reader of history to feel it; otherwise the labor of all three is but vanity and vexation of spirit. The historian who writes without suggestion, the teacher who teaches without inspiring, the reader who reads without pondering,—each fails in his separate sphere.

It was Mahan who first saw the deeper significance in naval history. His philosophy of sea power in its quiet but solid way did more for the navies of the world than the more visible performances of some who have received greater acclaim. It was Mahan perhaps who first taught that historical study is practical because it ends in action. But it ends in action only when undertaken in a serious spirit and accompanied by a proper measure of reflection. Those who have caught this idea, who have learned to read naval history, not as they would scan the headlines of the morning paper or the pages of the latest novel, but as fraught with meaning and suggestion, cannot fail to attain unto a larger sphere of usefulness in their chosen profession. If this, too, was not the aim and the hope of Mahan then I have pored his pages over in vain.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ECONOMIC DEVELOPMENT OF GUAM

By CAPTAIN ROY C. SMITH, U. S. Navy
Late Governor of Guam

Periodically there appears in the pages of the PROCEEDINGS an article on the possibilities of Guam. One of the last, and a most interesting and valuable article, was by Paymaster K. C. McIntosh, U. S. Navy, under the title of "War Provisions for Guam" (No. 162, March-April, 1916). It described the situation in Guam, under the Spaniards and under the Americans, and concluded that though the island could support, and had in former times supported a large population, agriculture had almost ceased to exist, on account of wages paid to laborers by the government and food shipped to the island by army transports. The wages enabled the natives to buy imported food, and the food shipped by the supply department for the American garrison lessened the local demand.

These causes still exist and are very deterrent in their effect. To them may be added the money received for copra, which enables the natives to buy imported food. Certainly there are no objections to copra as a money crop, *per se;* but economically it would be preferable under present conditions to grow food instead. Sufficient food first, then money crops, is a better principle.

The present article is not intended to deal with national policy, or with strategy. Whatever the future of Guam, the island should be cultivated to its full capacity. This will be true whether it is to be utilized as a naval base of the first order, or is simply to be administered for the benefit of its inhabitants. The soil in Guam is the only possible source of wealth. If cultivated it can support a large garrison, as well as the population; and such procedure will in any event result in prosperity and wealth to the island.

The food situation became very acute at one time last year, owing to interruptions in the transport service and a destructive typhoon that swept the island about the same time. Efforts had already been made to encourage production, but at this period it became apparent that something more than persuasion was necessary. It was a situation likely to recur and heroic measures were needed. An effort will now be made to describe some of these measures and their apparent effect in the brief time that has elapsed.

The population of Guam lives mostly in the towns, though almost every native family has a farm in the country, ranches as they are called there. These ranches are at varying distances from the towns, the most distant sometimes as far as ten or twelve miles. It had been the general custom of the natives to visit their ranches during daylight, on foot or by bull cart, returning to town in the evening. There was no realization that the time thus spent was a total loss. Time means nothing to Pacific islanders and the loss of nothing meant nothing.

Moreover, 60 per cent of the population of the island live in the one town of Agana; and probably three-fourths of these have no strictly town occupation, they merely live there. Under such conditions agriculture is at a minimum.

The population of the island is about 15,000, of whom about 14,000 are natives. There are about 3,000 able-bodied male natives between the ages of 16 and 60. Boys in Guam finish school and go to work at the age of 16. About 600 natives are employed steadily by the federal or island governments. Some 400 more are engaged in town occupations. This leaves about 2,000 for agriculture, without counting the women. The area of the island is something over 200 square miles, about half of which is suitable for crops or pasturage. This works out 32 acres per man for tilling or grazing. This would be far from excessive with modern methods and implements and the aid of the women. The actual present practice, though on the increase, is not a fraction of this amount.

Another deterrent to production is the lack of any storage facilities. Insects, moisture, vermin, typhoons, may quickly destroy any produce remaining over from current needs. It is even difficult to save seeds from one crop to the next. Some of the Spanish governors tried the experiment of providing granaries,

but it was not successful for one reason or another, probably premature.

Cattle, pigs, and poultry are food possibilities also. The cattle, though often stunted, seem to thrive when well cared for. They are sometimes bothered by ticks, but ticks can be controlled in one way or another. One trouble with the cattle was that castration was not generally practiced. The native was apt to pick out the larger and stronger animals for work, which resulted in leaving the runts for breeding. The result was what might have been expected. This has been corrected. Bulls for breeding are selected and registered. They pay no tax. All other bulls are taxed. Young bulls are castrated by the government free of charge. Only steers, oxen and barren cows are allowed to be killed for the market.

Pigs are generally in evidence, but they suffer from a number of diseases. The experiment station which the Department of Agriculture maintains in Guam is studying these and other diseases of animals and will in time find the remedies. Their conclusions and remedies are at the disposal of all the inhabitants.

All kinds of poultry are found on the island. The matter of increasing the production is one of care and attention. Heretofore rats have destroyed many of the eggs. Cock-fighting is harmful, for biological reasons. The native saves his roosters for fighting and eats the hens. The reverse practice would be better for production. A campaign against cock-fighting is in progress. It will die hard, as it is the one absorbing amusement of the natives, dating back into Spanish times. It also brings revenue to the island government. But it is probably doomed.

The sanitary condition of the island is a factor in production. Since the American occupation this has much improved. There is a special annual appropriation under the Navy Department that is available for sanitary purposes. It amounted to $14,000 until a couple of years ago when it was increased to $20,000. Leprosy has practically disappeared. If a case is found it is at once transferred to the leper colony at Culion in the Philippines. The most serious present difficulty is intestinal and other parasites. Such large numbers of natives have in times past lived in such restricted areas, and do still for that matter, without adequate sanitary provisions, that the soil is infested with parasites. Hookworms are the most dangerous, though there are other varieties.

There are two remedies, education and the adoption of sanitary provisions and measures.

Through the interest of the Bureau of Medicine and Surgery and of the Rockefeller Foundation of New York, Dr. John B. Grant, of the International Health Board of that foundation, spent a month on the island last year examining local conditions from the standpoint of the board's work in other localities. He found that soil infestation was wide-spread, principally in the towns. The percentage of hookworm infection among the natives was 72, of a light to moderate character. His recommendations were that the sanitary orders already in effect should be strictly enforced, and that the proposed improvements should be carried out as rapidly as funds should be available. This was gratifying to the authorities. Money is the greatest need.

Communications play a large part in production. Bull cart roads and trails were the only means until a few years ago. Under the Americans, improved roads have gradually appeared until now there are about 75 miles. This is not nearly enough, as many parts of the island still cannot be reached.

There were no markets until very recently, excepting a small market for the white population. This is partly explained by the lack of communications. But in addition, the native knew nothing of specialized labor. He made or grew everything he needed for his own use and gave away the surplus, if any. Even trade and barter were little practiced.

Vermin also were a great deterrent. Rats simply swarmed. There were thousands of them. They ate nearly everything green, also seeds, in and out of the ground, and destroyed the eggs of wild birds and fowls. A large lizard, called locally iguana, also did much damage, principally to the eggs and young of birds and fowls.

Rather a formidable list of obstacles to overcome before production could be made to reach a reasonable figure. But the attempt could at least be made, and has in fact been made, and with results that are far from discouraging.

One of the first measures was to go after the rats and iguanas. All the available literature on rat campaigns was examined. As a result, the bounty system was selected as the most suitable. The island government has paid, on the average, two cents a head for rats and ten cents a head for iguanas since the fall of

1916. The children have become the principal rat-catchers. They accomplish it mostly with home-made bamboo traps, or snares. Sometimes they dig out nests of rats from their holes in the ground. Iguanas are hunted with dog and gun.

In a period of 29 months, from September, 1916, to February, 1919, the total number of rats destroyed has been 1,783,937; iguanas 51,516; and the cost to the government has been $43,-674.71. This seems a large expenditure, but as a matter of fact the cost has gone right back to the people in bounties, whereas the gain has been immense. Estimating the damage at five cents a rat per month, which is the lowest estimate of rat damage to be found anywhere, and the average time gained per rat killed at 14½ months, the total damage saved amounts to about $1,300,000. The actual diminution in the number of rats and in the loss sustained is very noticeable. Iguanas have practically disappeared. Birds have increased largely. Animal ticks have decreased. It is thought the birds eat them. The cattle thereby profit. Damage to poultry is almost negligible; and lastly, agriculture has become possible. So far as known, and in relation to the area involved, there has been no rat campaign on a scale approaching this one.

There is sometimes question of discontinuing the bounty, due to lack of revenue. This would be suicidal, unless an equal number of rats can be destroyed by some other method. There may be loss of revenue, but there is no loss of money to the people. Every other expenditure should be abandoned rather than this. To discontinue now, when the battle is largely won, would be, for the reason that rats breed so rapidly, to revert in a few months to the former situation, which was intolerable; and the whole effort up to now would be lost.[1]

The next matter to be taken up was markets. There had been for a long time a small market where the surplus from the government gardens and farms was disposed of to the families of officers and other Americans. About two years ago it was decided to try to do something in this direction for the natives. A small market-house was built by the island government and opened as a weekly market on Saturdays for the benefit of the natives. All farmers were urged to send produce to this market. In this

[1] Since the above was written bounties have been discontinued and all male inhabitants over 16 are now required to bring in a certain number of rats. A prize competition has also been instituted.

they were assisted by the government trucks and the station tug. This market, though not a financial success at first, grew in importance, and eventually, last year, two larger buildings were constructed, one for a meat and fish market, and the other for vegetables and fruits. It was discovered that excellent fish weirs, inside the reefs, could be made with chicken wire and would outlast other forms of weirs. By these means an abundance of fish was secured. The markets have quite demonstrated their usefulness, have helped to stimulate production, and when there are more roads and better means of transportation they will be indispensable.

The next measure was an annual industrial and agricultural fair. This takes place in Agana in the week of July 4 and lasts about three days. There have been two so far. (Spring of 1919.) They are much of the nature of our county fairs. There are prizes for the best displays of every variety. The island government is now arranging to buy all the desirable industrial exhibits and sell them later in a government store. In addition to the exhibits there are military and civil parades, sports and games, eatables and drinkables (soft), and amusements of all descriptions. The fair has become a fixture. The committee is now busily at work arranging for the third exhibition. The influence of the fair is very marked. The mere gathering of the people, as well as the introduction of the competitive element, and the prizes themselves, stimulate production to a marked extent.

In the above measures great assistance was rendered by the insular patrol. This is an organization that has grown from small beginnings. Three years ago it consisted of 12 noncommissioned officers and privates detailed from the marine garrison. Their duties are partly military and partly constabulary. They report on roads, trails, bridges, landing places, defense positions, water supply, sanitation, food, damage by rats, bird-life, animal ticks, agriculture, crops, fishing. They also prevent violations of forestry laws, liquor laws, game laws and damage by stray cattle. They have charge of the military training of the natives. Their numbers have gradually increased, owing to the extent of their work and the wide variety of their duties. They numbered about 60 in the summer of 1918, after prohibition went into effect, and after the great destruction wrought by the typhoon of July 6 of that year, when it was necessary to put forth every

effort to increase agricultural production. The members are selected from the marine garrison of over 400 for intelligence, character, military qualities and knowledge of country life.

It is thus seen that the duties of this organization, while partly military, are also largely civil, the performance of which might be to the detriment of the military efficiency of the garrison. But on any alarm they return at once to their regular station, and they go through all the firing practices with their companies. After all, the duties of the whole naval personnel in Guam are in the main civil. The naval station exists in name only, as it has no facilities for supplying or repairing ships. The principal duty of the naval personnel is to conduct the "Naval Government of Guam," which is the official title of the government. The members of the insular patrol are thus carrying out their principal duty, and they are in effect the most useful and valuable organization on the island.

Universal military training has existed in Guam for over two years, or since March 15, 1917, prior to the entry of the United States into the world war. This movement was described in the NAVAL INSTITUTE PROCEEDINGS, No. 187, September, 1918. Briefly, instruction begins with the school children. The boys assemble four mornings in the week before school, and have three-quarters of an hour drill under the insular patrol. The exercises are Swedish movements and the simple military movements without arms. At the age of 16 they finish school and join the Guam Militia. Service in the active militia continues until the age of 23, when they pass into the reserve.

The movement has been most successful. There are practically no requests for exemptions. The force is uniformed, armed, equipped, they have their own native band and carry the new island flag, recently designed, along with the national colors. In addition to their rifles they have the 4-inch battery and machine guns of the late German ship *Cormoran*. The active militia numbers about 1,000. The reserve will in time number as many, or more. This figure of the active militia represents 7 per cent of the native population. The same figure in the United States would mean 7,000,000, or more, uniformed, armed and equipped troops. The Guam Militia has lately been taken over officially by the Navy Department and is now an organized force under control of the United States.

This movement is doing much for the island. The effect on the physical and mental development of the young natives is already marked. The discipline and training received in the militia should increase their efficiency as citizens manyfold.

The importance of road-making is now recognized. Congress has included lately a modest annual appropriation for that purpose. Highways have been planned eventually to cover the island, surveys for which are in progress. The usual cutting, blasting, and filling are required, also a number of concrete and steel bridges. Decayed coral, or *cascajo,* as it is called locally, forms the usual roadbed; but it washes rather badly in the rainy season, and it will not stand heavy hauling. *Tarvia* is being tried as a binder, but for the main roads there will have to be some form of macadam, or bituminous macadam. With good roads agriculture will be greatly stimulated.

The matter of taxes, and their proper incidence, has been the subject of much consideration. The island government is supported by its own revenue. The federal government appropriates for the naval station and garrison, and helps with schooling, and incidentally with sanitation, water systems and roads. The sources of the island revenue are the tariff, internal revenue, and taxes. Prohibition cut off a large part of the tariff revenue. Of course the island has as much money as before, plus what would have been spent on liquor. The problem is to get some of it in the shape of taxes. One of the largest items of expense is the rat bounty. But this means nothing economically, for the money goes right back to the people; and the island is vastly richer by the decrease in depredation of the rats. There is a different distribution of this money, but it goes finally to people who have well earned it; and those who do not earn any of it are in a position to stand the expense.

Taxes should be laid as much as possible to promote desirable objects and to discourage practices that are undesirable. The most desirable object is to increase agriculture. Second only to that is the improvement of the sanitary conditions in the towns, as already related. The conditions in the towns would be much improved if about two-thirds of the inhabitants would move into the country. This would also help agriculture. This points to a low tax rate for the country and a higher rate for the towns. Hence in the revision of the taxes after prohibition became

effective, the country taxes were not increased, except as necessary to provide for the rat bounty. But, as already explained, that can all be recovered and is recovered. The town taxes were very materially increased. However, about 43 per cent of these taxes were set aside for sanitary and other improvements in the towns in which collected. These improvements are absolutely needed, and if the people insist on congregating in the towns they must expect to pay the necessary expense. Sanitary, and other regulations in the towns, apart from taxes, include suitable cubical air space per occupant of dwelling houses, suitable stables or shelters for horses and cattle, pigs not allowed in towns, proper spacing of houses, suitable methods of construction, and suitable sewer connections or sanitary toilets.

The present tax rate on real estate for all the above purposes is 3½ per cent in the towns and 3 per cent in the country. The present average price of unimproved land is $4 an acre. Hence the tax is 12 cents per annum per acre. This is nothing if the land is used. It may easily be recovered by catching rats. Also, there is a bounty of 20 cents an acre for all cultivated land. The rates could evidently be materially increased in both town and country without hardship. They may have to be increased to provide needed revenue. But if the relative rates are maintained agriculture must thrive, the towns can be made sanitary, and harmful parasites will be eliminated.

In connection with sanitation is the question of suitable quarters in suitable sites for the naval garrison. Irrespective of the location of the future naval station the needs of the present garrison are to be considered. Two of the three companies of marines are quartered at Sumay, which is a healthful and agreeable situation, where breezes are to be found most of the time. Some of the enlisted men of the navy and marine corps are quartered at Piti and Asan, where the accommodations are adequate and the situation good. The rest of the garrison, the officers and their families are at Agana, the capital. This will always be the site of the civil government and the residence of the officers and enlisted men of the navy and marine corps who help in any way with the "Naval Government of Guam."

Agana is a town of 9,000 inhabitants on a low flat stretch of coast land six to eight feet above sea level. Immediately back of the town are hills 150 to 200 feet high that cut off all the breeze

encouraging for the future. The island can thrive if the inhabitants once learn the value of labor. They have sometimes been called lazy. They are not lazy when they are interested. They are often idle, when they see no object in working. So are other people.

Damage from typhoons is always to be considered. Destructive typhoons are fortunately rare. In the intervals the natives forget and the Americans change. Certain conclusions are to be drawn which have been made a matter of record. They should be kept in mind and followed.

The old Spanish structures suffered least. They were an evolution of two centuries. The walls were thick and the houses low, not over two stories. This was partly to resist earthquakes, which sometimes occur. The roofs were of tiles. The eaves did not project far and there were fillets underneath to shed the wind. There were few porches and few projections for wind lodgments. Where damage occurred to these structures it was mostly in changes made by the Americans, as in the galvanized iron roofs, with overhanging eaves, which often blew away.

The bungalow type of houses, with wide porches, is unsuited. The porches sometimes blow off; and if they have an iron roof in common with the house the whole roof is apt to go. Two new houses of this character were lifted from their foundations and dropped gently a few feet away while partly wind borne.

The native houses, generally of wood on piles, with thatched roof, were mostly unroofed and sometimes blown down. It has been the custom in times past to lash down these houses with ropes of bark, passing over the roof and set up like tent guys. This is a good practice to continue and would probably save many of the houses.

Growing crops generally and trees must take the blast, but the crops can be a good deal sheltered by windbreaks. There are several hardy shrubs on the island that grow rapidly and form dense hedges. They have been utilized to a limited extent in the past, but not nearly enough. Rules making them obligatory in effect could be devised and are in fact necessary. The labor involved is slight, and the hedges would largely take the place of fences, which are neded to keep out cattle and which are expensive. The hedges would afford considerable shelter to growing crops.

Apart from the effect of typhoons, seeds are with difficulty saved

from one crop to the next. Moisture, vermin and insects soon make an end of them. Air-tight, water-proof, fire-proof, and rat-proof bins are needed for the seeds alone. Typhoon-proof granaries of the same character as the bins are needed to store the surplus crops. Owing to the absence of any storage facilities there has been no inducement in the past to grow more than necessary for current needs.

Food by transport for the garrison has had the same effect in minimizing the incentive to production, as pointed out in Paymaster McIntosh's article; only the evil has grown worse. During the last fiscal year (1917-18) the cost of this food was $216,000. The freight charges were $19,600 and losses by survey $1,400. The total cost was thus $237,000. The garrison comprises about 500. Adding the families of officers and other Americans and the enlisted natives having commissary privileges would bring up the total to about 1,000 persons. Hence the average per person is about $20 a month. This amount for raw food in the tropics is entirely absurd. The greater part of the articles involved are grown or raised on the island at the present time, though not in sufficient quantities. Nearly all could be provided locally. Some few articles are not grown in the tropics. At one time recently, as a mere example of current practice, there were 10,000 tins of string beans in the commissary store; and string beans, the best in the world, grow in Guam every day in the year. This situation is well known to the Department, but no method has yet been devised for correcting it. Government stock and agricultural farms would be the solution, but existing appropriations are not available for such use.

There is however a method of stimulating production for which fortunately there is now an encouraging prospect. A great trouble with the natives is lack of capital. With capital they could obtain modern farm implements and machinery and could build granaries for surplus crops. The method of rural credits seemed a partial solution; and, after the recent typhoon, this was recommended to the Department. As a result there is a provision in the appropriation bill that recently failed, and which will without doubt be included in the next bill, that reads as follows:

For rehabilitating the island of Guam on account of typhoon of July 6, 1918, to be paid to and expended in the discretion of the Governor of Guam, including the preservation from the weather, vermin, and insects of surplus crops and seed, the purchase of farming implements and farm


STRAIT OF GIBRALTAR
View C
A
B
C
Yellow Color
Circular Tower landmark
Sharp Cliff many peaks
Triangular

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CHART STUDY AND PREPARATION

By Lieut. Commander R. R. Mann, U. S. Navy

Officers spend much time in perfecting themselves in deep sea navigation where the ship is not endangered, but do not always acquire the maximum knowledge available before piloting into port where the danger really exists. Recent courts-martial have proven this fault. To gain this knowledge it is necessary to study all data possible and the best method of study is to work on the charts themselves, preparing them for use. A very simple method of chart preparation, and therefore study, used with success on the Asiatic Station and in the Mediterranean in entering unfamiliar ports is here described.

1st. Be sure that all navigational books and charts are correct to date by the latest hydrographic bulletins and notices to mariners.

2d. Look up chart catalogue and pick out all charts for that vicinity which can possibly be of use.

3d. Mark the landfall chart (smallest scale) No. 1, the next to be used No. 2, the next No. 3, etc., down to the largest scale chart which will necessarily be the harbor chart.

4th. On No. 1 chart draw a rectangle, preferably in blue pencil, showing the limits of No. 2 chart. On No. 2 chart draw a rectangle showing the limits of No. 3 chart, etc., down to the largest scale chart. Mark the rectangle with the number corresponding to that chart for reference. The charts are now numbered consecutively so the next largest scale chart available can be immediately used when the ship's position comes into that rectangle.

5th. Now look up light lists and check radius of visibility of lights with radius given on the chart. With a compass draw circles of visibility adding distance the light itself, not the glare, can be seen due to your own height over 15 feet as indicated in Table 14, Bowditch.

6th. Next lay off sectors of visibility through which lights can be seen as given by the light lists, keeping in mind the heights of

hills and objects in range and that the bearings are given as observed from sea.

7th. Color light-houses, circles of visibility and sectors of lights with colored pencils using red for red, green for green and yellow for white. A satisfactory scheme for quick identification is:

For a fixed light, color the whole visible segment of the circumference.

For a flashing light, make dots with large spaces on the circumference.

For an occulting light, make long dashes with small spaces.

For a group flashing light, make a group of dots then a space.

For alternate red and white flash, alternate colors of the dots.

8th. Note in pencil by each light the following information as obtained from the light lists: characteristic appearance of the light-house, fog signals, submarine signals and intervals of flashes so the light can be checked with a stop watch.

9th. Color all buoys and beacons with their respective colors but remember that a buoy is often out of place and should be considered more as a warning than an infallible navigation mark. Rely on ranges and bearings of known landmarks.

10th. From information in the sailing directions mark on the chart in pencil any conspicuous and prominent hills or objects so they can be readily identified as landmarks.

11th. Look up the coast and geodetic survey tide tables and find the state of the tide for the time the chart is to be used, not forgetting that the times given are for high and low water and not turns of the current or slack water.

12th. If advisable trace line of depth next greater to the ship's draft and any mine areas, wrecks or shoals to be avoided preferably with a red pencil.

13th. Remember the following are unreliable: sound signals in a fog, unwatched lights and buoys and charts that have become distorted by dampness.

The example given is No. 2 chart entering Gibraltar from the Atlantic.

The advantage of this system is that all data available from all sources of information is concentrated on the chart in plain view.

A navigator who makes these simple chart preparations once will be astonished at the knowledge and confidence acquired.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A HANDY GUIDE TO THE NAVAL HISTORY OF THE WORLD WAR, 1914 TO 1918, AS FOUND IN THE UNITED STATES NAVAL INSTITUTE PROCEEDINGS, ESPECIALLY THE NAVAL WAR NOTES

By WALTER B. NORRIS, Associate Professor of English, United States Naval Academy

The following guide to the part played by the navies in the World War from 1914 to 1918 includes only what is found in the NAVAL INSTITUTE PROCEEDINGS, especially the Naval War Notes, on the chief events of the war. Insignificant skirmishes have been omitted, but a wealth of material—official reports, newspaper accounts, personal narratives, and contemporary discussions—has been discovered and rendered accessible to the reader. American matters have been rather exhaustively dealt with, and every ship which engaged in actual fight with an enemy has been included as far as the PROCEEDINGS extend. Wherever articles in the body of the magazine furnish historical data, as, for instance, von Mücke's story of the *Emden*, translated by Lieut. Klein, they have been noticed, as well as all illustrations of value. The table of losses of ships by all belligerents found in the PROCEEDINGS for July, 1918, is complete to that date and is continued in later issues as losses occurred.

MINUTES OF THE ANNUAL MEETING, 1919

U. S. NAVAL ACADEMY, ANNAPOLIS, MD.,
OCTOBER 10, 1919.

In accordance with Article V, Section I of the Constitution, two week's notice having been given, the annual meeting was held in the Board Room of the Officers' Mess.

Captain W. T. Cluverius, U. S. Navy, Chairman of the Board of Control, presided.

The minutes of the last meeting were read and approved.

The first and stated business being the election of officers, the following tellers reported the vote, having been appointed by the President 10 days previous—

Commander A. P. Fairfield, U. S. Navy.
Commander C. M. Austin, U. S. Navy.
Commander B. R. Ware, U. S. Navy.

The tellers reported the results of the election as follows:

For President

Rear Admiral B. A. Fiske, U. S. N	611
Rear Admiral Ralph Earle, U. S. N	325

For Secretary and Treasurer

Commander S. A. Taffinder, U. S. N	644
Commander R. A. Theobald, U. S. N	284

For Board of Control

Captain W. T. Cluverius, U. S. N	791
Captain E. J. King, U. S. N	703
Captain T. L. Johnson, U. S. N	650
Captain W. G. DuBose	579
Captain Amon Bronson	372
Commander B. C. Allen	325
Lieut. Colonel J. W. Wadleigh, U. S. M. C	305
Commander Thomas Withers, U. S. N	252
Captain Charles Conard (PC), U. S. N	231
Commander A. A. Corwin, U. S. N	218
Commander C. R. Hyatt, U. S. N	196

Commander A. S. Kibbee, U. S. N. 184
Commander H. K. Hewitt, U. S. N. 184
Commander I. C. Bogart, U. S. N. 134
Commander G. H. Bowdey, U. S. N. 133
Commander G. P. Auld (SC), U. S. N. 117
Miscellaneous:
For President 3
For Secretary and Treasurer 3
For Board of Control 30

A. P. FAIRFIELD, Commander, U. S. Navy.
C. M. AUSTIN, Commander, U. S. Navy.
B. R. WARE, Commander, U. S. Navy.

The following officers were then declared elected:

President

Rear Admiral B. A. Fiske, U. S. Navy.

Secretary and Treasurer

Commander S. A. Taffinder, U. S. Navy.

Board of Control

Captain W. T. Cluverius, U. S. Navy.
Captain E. J. King, U. S. Navy.
Captain T. L. Johnson, U. S. Navy.
Captain W. G. DuBose (CC), U. S. Navy.
Captain Amon Bronson, U. S. Navy.
Captain B. C. Allen, U. S. Navy.

The following motion was passed:

Resolved, That it be the sense of the meeting that the Constitution be amended by presenting the matter to the membership as required by the Constitution, changing the words "two dollars and fifty cents" to "three dollars" in Article VII, Section 8, making the section read:

"The annual dues for regular and associate members shall be three dollars, all of which shall be for a year's subscription to the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, payable upon joining the Institute and upon the first day of each succeeding January."

During discussion it was explained that the necessity for this amendment is that the cost of paper has more than doubled in the last year and that the cost of the PROCEEDINGS has increased 36 per cent. The loss in publishing the PROCEEDINGS now amounts to about $10,000 to $12,000 annually, the loss being made up by the Book Department of the Institute. This last increase will make the annual loss on the PROCEEDINGS about $16,000 to $18,000. In

order to partly take care of this loss this amendment is proposed. The Secretary was unanimously authorized to present the amendment for the consideration of the membership.

The Secretary and Treasurer presented his annual report as follows:

1. In the history of the Naval Institute the period from December, 1917, to July of this year has been the most prosperous, due to the expansion of the Navy and the government contracts for service books, which the Book Department of the Institute filled.

2. The increase in membership, however, was not in proportion to the increase in business. The present circulation of the INSTITUTE PROCEEDINGS as of October 1, 1919, is 6460 copies, divided as follows:

Honorary members	4
Life members	139
Regular members	4934
Associate members	510
Subscribers	798
Exchanges	32
Advertisers	43

which shows a slight gain in membership over the previous year.

3. Since the commencement of the monthly issues, the PROCEEDINGS have been published at a yearly loss of approximately from \$10,000 and \$12,000, which has been borne by the Book Department.

4. During the last year increased cost of paper and press work will bring the annual loss, due to this item, to about \$16,000 to \$18,000. It is believed that this fact is not realized by the membership at large. If the annual dues are raised to \$3.00 this will take care of part of the last increase in the cost of the publication of the PROCEEDINGS.

5. Constant efforts are being made to increase the advertisements carried in the PROCEEDINGS, and the revenue now realized from this source amounts to \$3600 per annum, an increase of approximately \$1500.

6. A new system was inaugurated in January of this year in connection with the financial condition of the Institute, a statement being prepared and submitted to the Board of Control at each monthly meeting.

7. The net worth of the Institute reached its highest point in August of this year, at which time it was $183,736.65.

The report of the Secretary and Treasurer was adopted.

There being no further business the meeting adjourned at 8.15 p. m.

S. A. TAFFINDER,
Commander, U. S. Navy,
Secretary and Treasurer.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Membership Life, regular and associate membership, 5649. New members: 4. Resignations: 5. Dropped: 1. Deaths (1).

Rear Admiral E. C. Pendleton, U. S. N.

Dues It is requested that all members who have not paid their dues up to and including 1919, do so before the annual audit, January 1, 1920.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

Address of Members *All members are urged to keep the Secretary and Treasurer informed of the address to which* PROCEEDINGS *are to be sent, and thus insure their receipt.* Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 15th of each month.

Book Department The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, 155 and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., OCTOBER 15, 1919.

INFORMATION INDEX

PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER WALLACE L. LIND, U. S. Navy

GENERAL ARRANGEMENT

FRANCE

THE FRENCH BATTLESHIPS.—At the beginning of the war there were five battleships on the stocks in France, all of the same type with a displacement of 25,200 tons and capable of steaming at a maximum speed of 21 knots. Four of them—the *Flandre, Gascogne, Normandie,* and *Languedoc*—were launched during the first few months of the hostilities, but their armament was suspended on account of the arsenals being engaged upon the production of guns and munitions. The turrets built for the *Gascogne* fell into the hands of the Germans. The fifth battleship, *Béarn,* has remained on the stocks ever since, and is still uncompleted. The question now arises whether these vessels should be equipped or abandoned and their cost put to the profit and loss account. The ships were to have been fitted with three quadruple turrets to receive twelve 340 mm. guns, and the thickness of the armor at the water line is 320 mm. Even at the time the four were launched they were inferior to the then latest foreign battleships, and now they are of course hopelessly outclassed. Owing to the heavily increased price of materials, the cost of completing the ships would far exceed the original estimates, and as their value as fighting units has enormously depreciated, there is a general opinion that the battleships should be scrapped. There is also a great deal of difficulty in preparing a new program of naval constructions, for, apart from the heavy building cost at the present time, it is feared that with the existing price of coal it would not be possible to keep the ships at sea. There is no desire to build up a powerful navy if the ships are to remain permanently in harbor. It is admitted that the French navy is "passing through a serious crisis," and it will be interesting to see what solution is offered when the Government presents its program of naval construction..—*The Engineer,* Sept. 15, 1919.

RECENT CONSTRUCTION AT THE ROCHEFORT ARSENAL.—The large 830-ton submarine, the *Laplace,* the last of a series of six similar boats, was successfully launched August 12. The other five boats of this class are: the *Joëssel,* just commissioned at Cherbourg, and the *Fulton* recently launched here; the *Lagrange, Regnault,* and *Q-114,* built at Toulon. These are slightly

modified reproductions of the *Dupuy-de-Lome* and the *Sané*, built at Toulon in 1916, which performed good service on the Moroccan coast during the war.

Besides building numerous "cannonieres" for submarine hunting, the Rochefort has finished since 1914, the submarines *Chlorinde* and *Cornelie*, the large destroyers *Mecanicien-Principal-Lestin* and *Enseigne-Roux*, the submarines *Amphitrite*, *Astree* and *Bellone*, with Sabathe 2-cycle engines. —*Journal de la Marine*, Aug. 23, 1919.

NEW SCHOOL FOR OFFICERS AT BREST.—It has been decided to create a school at Brest for the purpose of "finishing those young officers whose courses at the Naval School were cut short on account of the war. All the ensigns who were admitted to the Naval School or the School for Student Officers since 1913, except those now actually in one of those schools, will take the new course. The course will last six months, with two sessions a year. It will probably open November 15.—*Journal de la Marine*, Aug. 23, 1919.

THE CRUISE OF THE "ALDEBARAN."—Under the command of Lieutenant Guierre, the sloop *Aldebaran* sailed August 20, (from Toulon) for a cruise in the Indian Ocean and the Pacific, for radio experimental work. The utilization of this type of vessel solves the problem of small cruisers for distant stations, the lack of which was keenly felt before the war. More than one young officer will envy his comrades of the *Aldebaran*, far away from the constraints of fleets. Ports of call will be plentiful. Among them: Djibouti, (our colony on the Somali coast, port of Abyssinia), the Seychelles, Diego-Suarez, (the Brest of Madagascar), Colombo, Batavia, Freemantle, Melbourne, Auckland, Noumea, (New Caledonia) and Papeete (Tahiti).—*Journal de la Marine*, Aug. 23, 1919.

HOW SOME OF THE FRENCH SUBMARINES WERE LOST.—1. The *Curie* left Brindisi December 17, 1914, for the purpose of entering Pola harbor to torpedo Austrian capital ships. She fouled the chains of the harbor barricade, and could not extricate herself. The boat became inclined 30 degrees, the storage batteries spilled, short circuits occurred and the air became unbreathable. Seeing all hope of saving the boat gone, the captain had all tanks blown, and managed to come to the surface, to be greeted by gunfire from the waiting Austrian vessels. The captain was wounded and his second was killed beside him, and several men were wounded. Before coming on deck the valves were opened and the boat soon sank. The captain would have gone down with her but was saved by a quartermaster in spite of himself. All the survivors were picked up. The captain later died as a result of his wounds. The *Curie* was subsequently raised and used by the Austrians.

2. December 4, 1915, the *Fresnel*, on patrol off the Albanian coast, went aground near the mouth of the Bojana. All attempts to float her were unsuccessful. An Austrian hydroplane saw the submarine at daylight, and sent news of her to several enemy torpedo boats, which soon arrived on the scene. The *Fresnel* was heroically defended, but after receiving several vital hits, it was decided to abandon ship. In four trips of the small boat all the officers and crew were landed on a small islet. An attempt was made to send the small boat to the mainland a mile away to get asistance, but she was attacked, a man killed, the others wounded, and she drifted until picked up by the *Novarra*. The men on the islet were attacked by rifle and machine gun-fire and after a sharp battle the captain decided not to prolong a useless resistance, and surrendered. The commanding officer was court martialed after being returned to France, and was acquitted.

3. At 2 a. m., December 29, 1915, the *Monge* was cruising about 15 miles south of Cattaro, when several enemy ships were seen. She submerged to attack, when a terrible shock was felt—she had been rammed by the cruiser

Heligoland, which had not been seen so close. The conning-tower plates were ruptured and water poured in. The safety hatch was immediately closed. But the submarine, inclining more and more, sank very quickly. At 60 meters (197 feet) an attempt was made to come up. At this moment, with an inclination of 30 degrees, the batteries spilled, and all lights went out. The crew, thinking themselves lost, cried "*Vive la France!*" However, she succeeded in arriving at the surface. She was a beautiful target, illuminated by searchlights of the enemy warships, and was soon hulled, causing her to sink a second time. The captain now decided to try to save as much life as possible. All tanks were blown, and the forward hatch, the only one out of water, was opened, all of the crew came out in good order, the enemy ceased fire, and their boats picked up the survivors, while the *Monge* sank for the last time, taking with her the captain, Lieut. Morillot.

4. September 15, 1916, in clear weather, off Cattaro, the *Foucault* was attacked by three hydroplanes. The explosions, though violent, did little damage to the hull, but a small stuffing box in the motor compartment was carried away, a stream of water fell on the motors, causing a short circuit, and the lights went out. A fire in the insulation of the cables started. The forced submerging continued, the steering motors having failed. She was finally brought up at 75 meters (246 feet). The hull resisted well at this depth, but a great deal of water was coming in. The captain was very cool and collected. He blew the after tanks to regain proper trim, then the central tanks to rise to 25 meters (82 feet) where they stayed, endeavoring to repair the damage, and to plug up the hole. But nothing could be done, not a single pump functioned, and so the boat was brought to the surface. The hydroplanes were beaten off, but not being able to start the engines, and knowing that Austrian vessels would soon be on the spot, it was decided to destroy the boat. A bomb was set to explode at 15 meters—this functioned, and the officers and crew were later picked up by Austrian torpedo craft. The commanding officer was acquitted by the court held after he was returned to France.—*Journal de la Marine,* Aug. 23, 1919.

THE FRENCH ARMY.—On the ratification of the Peace Treaty with Germany by the French Parliament, which is expected to take place this week or next, the French Army will be placed on a peace footing and will occupy its peace garrisons, with the exception of the troops detailed for holding the left bank of the Rhine. By October 4, at the latest, demobilization will have been completed, and only re-engaged men and the 1918 and 1919 classes of conscripts will be remaining with the Colors. But Class 1920 is due to be called up on October 1, and the foregoing numbers, together with contingents from the African and Colonial armies should, it is calculated, bring the total of the French Army on a peace footing to 750,000 men. This total would allow of a detachment of 75,000 men for the left bank of the Rhine, but Class 1920 will require at least three months' instruction before being fit for duty.—*The Army and Navy Gazette,* Sept. 6, 1919.

GREAT BRITAIN

DRASTIC DISARMAMENT.—Great Britain is reducing her navy in a most drastic way. Since the war she has sold or condemned over 150 ships, and the most amazing part of this disarmament is the fact that it includes every one of her big fleet of predreadnoughts. She has retained the *Lord Nelson* and the *Agamemnon,* presumably on the ground that their armament of four 12-inch and ten 9.2-inch guns puts them in the semi-dreadnought class.

The sweeping character of this disarmament affords food for thought by our Navy Department which is asking Congress for funds to bring our own predreadnoughts into fighting shape. With the single exception of the *Hood,* Great Britain has stopped work on all capital ships, that is, on all battleships and battle cruisers. We, ourselves, on the other hand, have six battleships and six battle cruisers under construction.

Dispatches report that the First Lord of the Admiralty is endeavoring to cut the present expenditures in half. The future navy is to include only dreadnoughts, battle cruisers, light cruisers, destroyers and submarines. All other ships are to be ruthlessly scrapped. Although all the capital ships that were under construction during the war including the *Anson, Howe* and the *Rodney*, 42,000-ton ships, sisters of the *Hood*, that were building at the end of the war, have been discontinued, 36 of the smaller vessels, scout cruisers, destroyers and submarines will be completed.—*Scientific American*, Sept. 27, 1919.

ACTIVE BRITISH FLEET SMALLER THAN OURS.—In an article in *The Daily Telegraph* on the peace reduction of the British Navy, Archibald Hurd says:

"It is an arresting fact that, judged by the strength of its battle squadrons in active commission, this country's supremacy has at least temporarily passed away. The United States has now in commission 31 battleships and the Navy Department at Washington plans to have 29 next year, that reduction in number being balanced by the increased power of a number of ships now being completed in the shipyards. We have in a similar state of readiness 22 battleships and five cruisers, and in accordance with the order published yesterday with reference to the reduction to the reserve basis—that is, care and maintenance parties—of the majority of the ships of the home fleet our instantly ready battle force will fall at an early date to 16, 10 of them forming the Atlantic fleet and the other six cruising in the Mediterranean—16, as compared with 29 under the Stars and Stripes.

"That comparison between the sea standing of the British and American fleets now and in the immediate future is not of much importance judged from the political or the naval point of view, but it is of interest. I doubt whether at any period during the last two or three hundred years the British fleet ever approached, much less has fallen below, an equality with any other power in its standard of commissionings, and we used to aim at a two-power standard."—*N. Y. Times*, Sept. 12, 1919.

BRITISH DESTROYER SUNK.—The Secretary of the Admiralty announces that H. M. destroyer *Vittoria* was fired at and sunk by torpedo in the Baltic on August 30, the ship sinking in five minutes. Two ratings are slightly wounded and eight are missing, believed drowned.

The *Vittoria* was a new destroyer, completed by Messrs. Swan, Hunter & Co. as recently as last year. She embodied the experience of the war and was of large displacement—about 1300 tons. Her length was 300 feet, and she had a beam of 29½ feet in association with a draft of 8 feet 10 inches. She developed 27,000 shaft horse power, and had a speed of no less than 34 knots. Her armament consisted of four 4-inch quickfiring guns, with one 3-inch anti-aircraft gun, and she was pierced for four torpedo tubes. Carrying normally about 367 tons of oil, the *Vittoria* had a large radius of action. —*The Army and Navy Gazette*, Sept. 6, 1919.

REDUCING THE BRITISH NAVY.—The need for strict economy in maintaining the British Navy in the future, in order that over-zealous economists in Parliament may not in reducing expenses allow the navy to decline below the minimum compatible with bare safety, is urged by the *London Engineer*. The German Navy, our British contemporary points out, has practically disappeared; Russia is not likely to become a first-class sea power for many years; and France and Italy will not spend money on large naval programs. This, it is held, removes all doubt as to the stability of Great Britain's maritime position in Europe.

"Nor for many years," says the *Engineer*, "is that position likely to be affected in other quarters of the world by the naval activity of the United States and Japan, which alone among the powers are continuing to build capital ships. In brief, our supremacy in every class of fighting tonnage is so great that no serious risk would be incurred if we suspended construction

altogether for a few years. That being so, the Admiralty, we fear, will find it difficult to explain to Parliament why it determined to complete 84 of the warships which were on hand when hostilities ended.

"In ordinary circumstances we should rejoice at the worthy manner in which it is proposed to display the flag in every part of the navigable globe, not from motives of chauvinism, but because we recognize the commercial and political benefits that flow from such a policy. But the present circumstances are extraordinary, and we doubt whether the country is in either the position or the mood to sanction the disbursement of a penny for which no direct return can be guaranteed. In respect of matériel there are methods by which the efficiency of the fleet can be not only maintained but increased without the heavy outlay entailed by new construction. The lines of technical development are clearly indicated by war experience. The possibilities of long-range gunnery have not yet been fully explored, neither has there been time to assimilate the lessons we have learned in regard to the best system of protection against gunfire and submarine attack. Ordnance experts tell us that if the guns in our ships had been able to fire at an elevation of 25 or 30 degrees, instead of at only 15 degrees, we should on several occasions have inflicted more damage on the enemy. It is known, too, that Germany secured excellent results with her elongated shells and with the reliable fuse fitted to her armor-piercing projectiles. Moreover, she possessed a marked advantage by reason of the superior mechanical efficiency of her torpedoes and mines. It is careful attention to these technical minutiæ that prepare the ground for decisive results in war, and research work of this kind is not so expensive as new construction.—*Army and Navy Journal*, Sept. 27, 1919.

BRITISH NAVY REORGANIZATION.—According to a dispatch from London, "the campaign for administrative economy is gaining momentum daily." Great Britain must make a sweeping reduction in expenditures and practice thrift in little things as well as great, or she will find it hard to meet her obligations. Mr. Lloyd George has sounded the warning, and where can a beginning be made so effectively as in the navy? The menace of the German fleet is ancient history now, and the empire has nothing to fear from any existing navy, militantly or politically. Her dreadnought line of battle is so strong that the United States would have to build steadily for several years to equal it if not a rivet were driven in British yards, and the United States is a friendly nation, prospectively an ally to keep the peace of the world. Compared with Great Britain, France and Japan are second class sea powers; necessity as well as sympathy and mutual interest bind France to her loyal ally with hooks of steel, and with Japan Great Britain has a hard and fast alliance. Aside from the fair promise of the League of Nations, Great Britain is now in a position to call a halt upon the expansion of her navy and to reorganize it on an economical basis.

The British Navy, like our own for that matter, is topheavy. It includes pre-dreadnoughts that are obsolete and can be broken up; many of the British cruisers and lighter craft are little better than junk for either offense or defense. The pre-war complement would be much too large for the navy after desirable elimination of ships. Mr. Walter Long, First Lord of the Admiralty, calculates that naval appropriations can be cut from £140,000,000 to £70,000,000. The plan is to have no ship in the service that is not a fighting ship of the first class, according to type. While work on 42 vessels has been stopped or canceled, 36 others, presumably light cruisers, destroyers, and submarines, are to be finished, but plants in the yards are to be kept up for an emergency.

This is a sane as well as a saving policy, and if red tape could be swept like cobwebs out of Admiralty halls, the British Navy should lose nothing in efficiency by the reorganization; but, of course, it will be necessary to put able and energetic men in the highest positions. Admiral Sir Percy Scott, who by the way insists that the naval lesson of the war is that large

battleships are an incumbrance, being of no use in the presence of well-handled submarines, has recently told the story of the unreadiness of the British Navy for the war with Germany, because no more than "10 ships of the whole fleet had their main armament fitted for director firing," a neglect that was due to stolid satisfaction with the old method. At the battle of Jutland, Sir John Jellicoe had only six ships fitted with a complete system of director firing, secondary as well as main batteries, and not a cruiser was among them. Furthermore, according to Sir Percy Scott, the German guns had the longer range in many cases. But perhaps the worst ineptitude of the Admiralty in 1914 was the belief that a battleship would be in no serious danger from an enemy submarine. So long as Baron Fisher was in authority the navy was progressive, and it is significant that his voice is now loudest for the plan of reducing the fleet to first-class fighting ships and adding no others.—*N. Y. Times,* Sept. 5, 1919.

AUSTRALIA TO HAVE FLEET.—Admiral Jellicoe's world tour of the various dominions comprising the British Empire has resulted in a report on Australia's future naval policy which indicates a wide expansion of the empire's imperial naval policy. A copyrighted dispatch of the *Philadelphia Public Ledger's* cable service states that Admiral Jellicoe's report has been forwarded to the government at Sydney, Australia, and warns that country "that she must cease playing with naval defense and take the subject seriously." The dispatch continues:

"In accordance with the Admiralty's redisposition of the fleets in the Pacific, Admiral Jellicoe finally scraps the former policy of the British Navy with subordinate local fleets and submits a scheme providing for a real imperial naval whose future under a unified command is dependent upon the continuous expansion of the dominion navies, on a standardization plan common to all. In other words, Admiral Jellicoe suggests that Australia may accept the responsibilities which are the inseparable aims of recognition as a nation.

"The present system of administration is condemned, while the personnel of the commonwealth's naval board is considered unsatisfactory because it lacks the practical service and knowledge necessary to provide an adequate base for the fleet at Sydney. It is not impossible therefore that another station will be required, and the Garson Island adjuncts may be sold for other purposes in order to attract officers and men. Admiral Jellicoe recommends salaries and wages closely approximating the opportunities of landsmen."—*Army and Navy Journal,* Sept. 9, 1919.

THE REVIVAL OF THE AMERICAN "MONITOR."—An unexpected naval development was the reappearance, during the war, of the *Monitor* type of our Civil War days. Of course, in the 50 years or more that intervened between the two great struggles, there had been a great development in the principles and practice of naval architecture, all of which was available to the British naval constructors when they adopted the principle of the monitor and applied it to modern conditions. Consequently, in the British monitors, we notice a great increase in size, free-board, sea-keeping qualities and offensive power.

Strictly speaking it is stretching the point somewhat to call the 6650-ton *Marshal Ney* a monitor, inasmuch as she lacks the essential quality of low free-board. In this respect the Italian monitor, *Fra di Bruno,* which is described as a great armored raft for carrying heavy guns, is more strictly in the *Monitor* class.

Monitors of the past war were built for seacoast work, and this was done in the North Sea mainly against the German batteries on the Belgian coast, and in the various operations against the Turks at the Dardanelles. In the case of the Italian Navy they were used for coastal work in the Adriatic. The British built 16 sea-going monitors and 18 river monitors. The sea-going monitors ran, in size, from 1260 tons to 8000 tons and the

river monitors had about 575 tons displacement. The armor protection, in the case of the sea-going monitors, consisted of belts of from 2" to 6", associated with 2" protective decks and 4" bulk-heads, while the gun positions carried armor of from 10.8" to 13.8".

The armament consisted, in the main battery of two guns, varying from 12" to 15" in caliber, and carried always in a single 2-gun turret. The speed in the majority of these vessels was 6.5 knots, but in the 1260-ton *Merseys* and in the 8000-ton *Erubus* and *Terror* the speed was 12 knots. The earlier river monitors mounted one 9.5" gun and the others two 6-inch. Their speed was 12 and 10 knots.

For the purposes for which they were used on the Belgian and Dardanelles coasts, a valuable feature of these monitors was their light draft, which was only 5' 8" in the *Mersey* class of 1260 tons and 10' in the *Marshal Ney* and other monitors of from 6000 to 6700 tons. This enabled the vessels to operate in the shoal waters which lie off the Belgian coast and in certain parts of the Adriatic.

The Italian monitor *Fra di Bruno* was one of the five ships, the others being the *Carso*, *Cucco*, *Monfalcone* and the *Vodice*. They were built, as we said, of raft-like form, and their low free-board and limited draft rendered them suited for work in the shoal waters at the mouth of the Piave River. They operated here in excellent concealment, and their powerful long-range 15" guns were of great assistance in checking the Austrian advance after the break through at Caporetto.

The monitor has always been considered as a strictly defensive vessel for operation along one's own coast-line and for cooperation with the forts in the protection of harbors and roadsteads. It is among the many surprises of the war that they should have been used in very strenuous offensive operations, in some cases at a great distance from their home ports. This, of course, was rendered possible only by the fact that Great Britain, and the Allies in general, had the command of the sea.—*Scientific American*, Sept. 27, 1919.

SEA AND HOME SERVICE DEFINED.—The Admiralty announce that, for purposes of drafting, service is to be divided into two classes, viz.:

1. *Sea*.—Service in all sea-going fleets and squadrons, except ships of the home fleet other than torpedo craft; flotilla leaders, destroyers, torpedo-boats and submarines, and spare crews appropriated to submarines; sea-going submarine depot ships; seagoing destroyer depot ships and repair ships attached to the Atlantic fleet; vessels employed on fishery duties; and harbor ships and establishments abroad.

2. *Home*.—Service in ships of the home fleet, other than torpedo craft; harbor ships and establishments at home and their tenders; depot ships for torpedo craft in home waters, except the seagoing destroyer depot ships attached to the Atlantic fleet; non-seagoing depot ships and bases for submarines; and in stationary ships at home and their tenders, other than vessels employed on fishery duties.

Men proceeding in a ship of war from home to sea service, or *vice versa*, and the nucleus crew of a ship of war employed in conveying relief crews, are to count the period of absence as sea service. So far as the requirements of the fleet will admit, service in all harbor ships and establishments and their tenders, including stationary ships, will be for two years.—*The Army and Navy Gazette*, Sept. 6, 1919.

SCAPA FLOW NOT BRITISH.—It will come as a surprise to many people to learn that the Orkney Islands, which include the great naval station of Scapa Flow, do not really belong to Great Britain in the sense that they were ever ceded by treaty or acquired by conquest. They were simply transferred by Denmark to Scotland in 1468 in pledge for the payment of the dowry of the Princess of Denmark, who was married to James III, King of Scotland.

In the deed of transfer, which is still in existence, it is especially mentioned that Denmark shall have the right to redeem them at any future time by paying the original amount of the dowry with interest to date. There is no likelihood, however, that Denmark will ever attempt to exercise her Right of Redemption, because 60,000 florins, the original amount of the dowry, would amount to perhaps several thousands of millions of pounds sterling—and that is a bit more than the islands are worth.

When the islands were given as security for the Princess's dowry, there is reason to believe that it was intended to redeem the pledge, because it was then stipulated that the Norse system of government and the law of St. Olaf should continue to be observed in Orkney and Shetland. Thus the udal succession and mode of land tenure (that is, absolute freehold, as distinguished from feudal tenure) still obtain to some extent, and the remaining udallers hold their lands and pass them on without written title.—*The Nautical Gazette*, Sept. 6, 1919.

A YEAR IN THE FLEET.—Just as they had concluded their midsummer leave and were on the point of starting on their cruises to the seaside resorts, *en route* to the northern bases, the ships of the Atlantic and home fleets were notified of the new arrangements which have been approved for regulating the work and play of officers and men throughout the year. The Admiralty have displayed posters on the ships giving an outline program of their prospective movements, with other information of great importance and interest, not only to those on board but to their families and friends.

From this program it is possible for an officer or man in the ordinary course of events to know in advance where he will be stationed at a given time, what amount of leave he is entitled to during the year, and from which port it will be given, and where his ship will have her periodical dockings and refits. This is a new departure and is made possible by the present international situation and the elimination of the German fleet. It could hardly have been done in the same way before the war, since it would have advertised the period during which our main fleets were at their maximum state of unreadiness. That it is given now is another indication of the care and consideration of the authorities for the interests and well-being of the ships' companies. The information in the new posters may be divided into three categories: That which concerns the movements of the fleets; the bases allotted to the various squadrons for exercising, manning, docking, etc.; and the important question of leave.

The outline program of movements shows that the custom inaugurated when Lord Selborne was First Lord in 1904-5 of bringing the squadrons together in February and October each year for combined exercises will be continued. From mid-December to mid-January is the winter leave period for the fleets, but in February and March they will carry out drills and exercises, which will be followed in April by the granting of the spring leave. From May to July inclusive the Atlantic and home fleets visit their northern bases, carrying out practices and exercises. Naval maneuvers will be the climax of this period of training, after which the fleets' regatta will be held. August will be given up to the midsummer leave period, and for the three following months, while the Atlantic fleet cruises around Great Britain and Ireland and returns to the northern bases for drills, exercises and experimental work, the home fleet carries out drills and exercises from Portland. It will be remembered that the February meetings for exercises started when Sir Arthur Wilson was commander-in-chief of the Channel fleet, were usually held off Lagos, and, although no locality is mentioned in the new plans, possibly the two fleets will again proceed to the portuguese coast for a similar purpose. Moreover, just as it was arranged in Lord Selborne's Memorandum of December 6, 1904, that the Atlantic fleet should come under the orders of the commander-in-chief of the Channel fleet, (then the premier force) once a year for combined exercises, so it is now laid down by the Admiralty that from May to July inclusive the home fleet shall come

under the orders of the commander-in-chief of the Atlantic fleet for the exercises which culminate in the summer maneuvers.

There is naturally, on the other hand, a great change to be noted in the plans now approved in regard to the bases of the two main fleets. Rosyth has been sufficiently developed during the war to be chief base of the battleships, battle cruisers, light cruisers and flying squadron of the Atlantic fleet, and also of the 1st submarine flotilla. The 2d and 3d submarine flotillas will be stationed at Devonport and Portsmouth respectively, while all the destroyers of the fleet will have their headquarters at Port Edgar. In the south Portland becomes a much more important base than it was during the war. All the ships of the home fleet will be stationed there and will give their spring and midsummer leave from this base, proceeding to their manning ports only to give Christmas leave. Invergordon and Scapa bases only, for the Atlantic fleet ships throughout the year and for the home fleet ships temporarily during the summer months. Perhaps the most remarkable feature of the future use of the various bases is the manner in which the three older yards at Portsmouth, Devonport and Chatham fall out of the list, so far as the Atlantic and home fleets are concerned. Except as manning ports, they are hardly mentioned in the new schedule. All the heavy ships in the fleets are to carry out their annual refits and dock at Invergordon or Rosyth; so are the seaplane carriers and the home fleet light cruisers. An exception is made in the case of the Atlantic fleet light cruisers, which will dock at Chatham. Only a few torpedo craft will refit at the manning ports, as the majority of these vessels will be accommodated at Invergordon or Rosyth. These arrangements are indicative of the manner in which during hostilities the Grand fleet ceased to be dependent upon the yards in the south. The facilities provided at the Scottish bases are of such a nature as to be able easily to cope with the reduced number of ships in the Atlantic and home fleets. Thus it comes about that battleships and light cruisers of the home fleet, stationed at Portland all the year round except for the midsummer cruise to the north, are to be sent to Invergordon or Rosyth for their refits. Except for the few torpedo craft, the southern yards are left entirely free for ships in reserve, and the reconditioning of merchantmen.

Leave arrangements must no doubt have proved the most absorbing topic to the majority of those who read the new schedule. An interesting experiment is to be tried of abolishing week-end leave in the Atlantic fleet, except when the ships are at their home or refitting ports, and of increasing, by way of compensation, the annual period of long leave from 28 to 42 days, to be given in three periods of 14 days each. A strong advocate of week-end leave was Admiral Lord Beresford, who described in his "Memoirs" how he altered the duration of this leave, from after dinner on Saturday to seven a. m. on Monday, and extended it from after dinner on Friday to noon on Monday. As Mr. Lionel Yexley pointed out in one of his books, Lord Beresford's interpretation of such leave was an extreme one, as "when the fleet was at its base at Portland, he made arrangements with the railway people for special trains, and granted leave each week-end from noon Friday to noon the following Monday, thus practically demobilizing his command for four days out of each week." Other admirals, of course, had very different views on this vexed question, and from the standpoints of the men themselves and the efficiency of the service, it is well that the Admiralty have laid down a definite line of policy which seems to have hit off a happy mean. Progressive training should benefit from the reduction in the amount of week-end leave, and the handsome compensation of 14 days' long leave will, no doubt, be satisfactory to most officers and men. On the other hand, the board recognize the hardship in keeping full crews on board ships while they are in their home ports or refitting, and in these leave from noon Saturday to noon Monday is approved. On the whole, the Admiralty deserve the thanks of the personnel for their sound-minded policy.—*The Army and Navy Gazette*, Sept. 6, 1919.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, AS REPORTED SEPTEMBER 30, 1919

Type, number and name	Contractor	Per cent of completion			
		Oct. 1, 1919		Sept. 1, 1919	
		Total	On ship	Total	On ship
Battleships					
43 Tennessee	New York Navy Yard	87.9	83.4	85.2	80.7
44 California	Mare Island Navy Yard	76.5	68.6	72.2	64.2
45 Colorado	New York S. B. Co.	32.5	13.2	30.1	10.3
46 Maryland	Newport News S. B. & D. D. Co.	54.3	46.5	53.	44.5
47 Washington	New York S. B. Co.	31.2	11.8	29.5	9.6
48 West Virginia	Newport News S. B. & D. D. Co.	26 3	2.5	25.1	2.2
49 South Dakota	New York Navy Yard	0.	0.	0.	0.
50 Indiana	New York Navy Yard	0.	0.	0.	0.
51 Montana	Mare Island Navy Yard	0.	0.	0.	0.
52 North Carolina	Norfolk Navy Yard	0.	0.	0.	0.
53 Iowa	Newport News S. B. & D. D. Co.	0.	0.	0.	0.
54 Massachusetts	Fore River S. B. Co.	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Fore River S. B. Co.	0.	0.	....	....
2 Constellation	Newport News S. B. & D. D. Co.	0.	0.	....	....
3 Saratoga	New York S. B. Co.	0.	0.	....	....
4 Ranger	Newport News S. B. & D. D. Co.	0.	0.	....	....
5 Constitution	Phila. Navy Yard	0.	0.	....	....
6 United States	Phila. Navy Yard	0.	0.	....	....
Scout Cruisers					
4	Todd D. D. & Const. Co.	32.	10.6	30.7	9.1
5	Todd D. D. & Const. Co.	29.	8.9	28.2	7.1
6	Todd D. D. & Const. Co.	23.8	1.8	23.3	1.6
7	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
8	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
9	Wm. Cramp & Sons Co.	16.	....	15.	....
10	Wm. Cramp & Sons Co.	16.	....	15.	....
11	Wm. Cramp & Sons Co.	5.	....	4.	....
12	Wm. Cramp & Sons Co.	5.	....	4.	....
13	Wm. Cramp & Sons Co.	5.	....	4.	....
Miscellaneous					
Fuel Ship No. 16, Brazos	Boston Navy Yard	98.8	98.7	98.6	98.5
Fuel Ship No. 17, Neches	Boston Navy Yard	33.4	23.1	30.	19.
Fuel Ship No. 18, Pecos	Boston Navy Yard	16.7	.2	6.2	.2
Gunboat No. 21, Asheville	Charleston Navy Yard	98.6	95.6	94.7	89.7
Gunboat No. 22, Asheville	Charleston Navy Yard	6.5	5.5	6.5	5.
Hospital Ship No. 1, Relief	Phila. Navy Yard	53.5	48.5	46.8	41.4
Amm. Ship No. 1, Pyro	Puget Sound Navy Yard	97.	93.	95.	90.
Amm. Ship No. 2, Nitro	Puget Sound Navy Yard	68.	54.	63.	48.
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	7.	0.	1.	0.
Destroyer Tender No. 3, Dobbin	Phila. Navy Yard	1.3	5.	0.	0.

There are 136 destroyers, 58 submarines, 6 mine sweepers, 14 seagoing tugs, 7 harbor tugs, 11 oil tankers and 8 Ford eagles in various stages of completion.

There were completed and delivered to the Navy Department during the month of August 12 destroyers, 2 submarines, 1 mine sweeper, 4 seagoing tugs, 9 harbor tugs, 1 oil tanker and 23 Ford eagles.

There are in addition 12 destroyers and 16 submarines authorized, but not under construction or contract. Miscellaneous vessels authorized but not under construction or contract (3): 1 submarine tender No. 3, 1 destroyer tender No. 4 and 1 transport No. 2.

NAVAL POLICY

WARSHIPS TO HAVE SEAPLANES.—Every American warship of the first and second class is to be equipped with a seaplane, it was learned at the Navy Department, September 13. This is to even up with progress already made by Great Britain.

This policy, with the corelative one of building a great fleet of dirigibles, is directly in line with the views of the naval war experts as to defense "in the next war."

They say the time has passed when a direct attack on sea coast cities like New York or Boston may be made by a battleship fleet, however powerful. The attack will be by seaplane, launched from a moving base of dreadnoughts at sea, navy officers assert. Hence the plan, now announced, to converting land planes into working seaplanes to be assigned to each of the larger ships.—*Aerial Age Weekly*, Sept. 22, 1919.

THE COAST GUARD.—The Coast Guard, which was placed under the jurisdiction of the Navy Department during the war, has been transferred back to the Treasury Department by President Wilson. Merchant marine and commercial interests asked for the change, while the Navy Department desired to retain jurisdiction.—*Shipping*, Sept. 13, 1919.

MORE MARINES FOR THE PACIFIC COAST.—Marine corps forces on the Pacific coast are to be augmented as a result of the creation of the Pacific fleet. Brig. Gen. Joseph Pendleton has been ordered to San Diego to establish the second Marine corps advanced base headquarters there. The force at San Diego will be increased from about 250 men to a full brigade. Complete equipment, including aviation and artillery material, will be kept in readiness, and the marine units at Mare Island and Bremerton will be absorbed into the brigade at San Diego. General Pendleton served two years in command of marines in Santo Domingo and acted as military governor there. He has had considerable previous service on the Pacific coast.—*N. Y. Times*, Sept. 26, 1919.

NAVY ASKS TO BE HEARD ON AIR BILL.—The opposition of the navy to an amalgamation of the government's air activities under a single head was expressed in no uncertain language by Acting Secretary Roosevelt in a letter to Senator Page, chairman of the Senate Committee on Naval Affairs, and to Chairman Butler, of the House Committee on Naval Affairs, on August 22. The Acting Secretary wrote:

"A bill, S. 2693, 'To create a Department of Aeronautics, defining the powers and duties of the director thereof, providing for the organization, disposition and administration of a U. S. Air Force, creating the U. S. Air Reserve, and providing for the development of civil and commercial aviation,' was introduced by Senator New on July 31, 1919, and referred to the Senate Committee on Military Affairs. I have requested the chairman of the Committee on Military Affairs of the Senate that the Navy Department be granted an opportunity to be heard on the bill before final action is taken, and I have been informed that such an opportunity will be granted. I write to call your attention to this bill, as its provisions vitally affect the policy of the Navy Department relating to aeronautics in the navy and marine corps, and it is the unanimous judgment of the responsible officials of the Navy Department that if the bill, in its present form, is enacted into law it will materially interfere with the efficiency of naval aviation."—*Army and Navy Journal*, Sept. 6, 1919.

BRITISH NAVAL INFORMATION CONFIDENTIAL.—Secretary Baker issued information on September 20 for the guidance of all concerned containing the following letter from the British Admiralty: "A considerable amount of information has recently been supplied to official represensatives of the U. S. Army, Navy and Government on technical matters connected with

naval material; *e. g.*, guns, torpedoes, mines, anti-submarine devices, signaling systems, etc. I beg to request that you will be good enough to arrange for all such information to be treated as confidential, and not to be published, except for the use of responsible officials of the U. S. Government." Secretary Baker directed that all information of this nature heretofore or hereafter received shall be considered strictly in confidence.—*Army and Navy Journal*, Oct. 4, 1919.

MATÉRIEL

THE U. S. S. "IDAHO" IS SPEEDY.—The U. S. S. *Idaho*, the latest battleship of the U. S. Navy, during its official speed trial on the North Pacific coast on September 29, 1919, attained a maximum speed of 22 knots and averaged 21 9.20 knots for the four-hour period, according to an Associated Press dispatch. These figures are said to be the highest ever attained by a United States battleship.—*Army and Navy Journal*, Oct. 4, 1919.

BASES FOR PACIFIC FLEET.—The Secretary of the Navy returned to Washington from the Pacific coast on September 22 and will soon submit data to the Senate and House Committees on Naval Affairs concerning necessary improvements and construction projects on the basis of facts learned by the naval mission to the Pacific coast. The battleships of the Pacific fleet will be based at Puget Sound and San Francisco, where there are efficient navy yards. Puget Sound may be selected as the fleet base, it is reported. Smaller stations may be established for the repair of small warships. Mr. Daniels said that no large fleet movements would be undertaken before January because of the necessity of overhauling the ships.—*Army and Navy Journal*, Sept. 27, 1919.

ADMIRAL FULLAM PREDICTS NAVY CHANGES.—Rear Admiral W. F. Fullam, U. S. N., contributed to the *New York Herald* of September 29 an article discussing the probability "that a complete revolution in naval architecture" may be forced upon us owing to the necessity of more powerful protection for naval vessels against torpedo attacks from the air and from under water. Admiral Fullam points out "there are five different methods of attack that involve the possible destruction of the immense and costly ships that are now regarded as the measure of sea power," and he foresees that as the result of these effective forms of attack, "the present types of dreadnoughts and cruisers will be driven from the seas." Admiral Fullam summarizes the methods of attack as the plunging fire of modern guns at extreme ranges of 16,000 yards and above, attack by bombing from aircraft, submarine mines, torpedoes fired from destroyers, and torpedoes fired from torpedo-planes. He illustrates how at extreme ranges projectiles rise high in the air and says that the impact of such projectiles on "the unarmored deck will inevitably penetrate to the vitals and cripple or completely destroy the ship." Aircraft will be more and more, he states, a determining factor in successful range determination, and he declares that "sea power, or fighting power, in the future will be largely dependent upon control of the air, and that fleet that secures this control in future battles must win, other things being approximately equal. In other words, aircraft will not only constitute dangerous offensive weapons in themselves, but they will contribute greatly to the accurate and effective use of a ship's guns in battle. They will be of double value, and from present indications airplanes will soon become one of the most invincible elements in sea power."—*Army and Navy Journal*, Oct. 4, 1919.

U. S. NAVY MAKES RAPID GROWTH.—The rapid rise of the United States as a naval power during the last two years is graphically demonstrated in figures showing the sea strength of the various world powers, compiled by the Navy Department's office of naval intelligence. They show that the United States, close pressed by France in 1917 for its place as third naval

power in the world, is now second only to Great Britain, and is at present pushing to completion a building program that will make the American Navy, for the first time in recent history, a formidable contender for first naval honors.

A little more than two years ago, the figures show, Germany, then second naval power, boasted more than 100 more ships of all classes than the United States, with a total tonnage exceeding that of the American Navy by nearly 200,000. Great Britain's fleet at that time numbered a total of 680 ships, aggregating 2,375,564 tons, as compared with Germany's 262 ships and 1,058,240 tons and the United States' 153 ships and 860,017 tons.

The completion of the present building programs, a matter of about three years, will find the chief of naval powers of the world with the following relative strengths: Great Britain, 955 ships, aggregating 2,772,542 tons; United States, 608 ships, totaling 2,117,922 tons; Japan, 170 ships, totaling 785,239 tons; France, 253 ships, totaling 719,237 tons, and Germany, 463 ships, totaling 923,437 tons.

As a result of the great torpedo-boat destroyer building program carried out by the United States during the war the American Navy now includes more than 150 destroyers of the fastest and latest type, with nearly 200 more building or contracted for. Great Britain owns about 425 of this type of vessel, many of them old and of little modern naval value, and have about 110 building or authorized. Germany's destroyer force has been so reduced as to make it a negligible factor. Japan owns 40 modern destroyers, according to the best available figures and have about 20 under construction.

Great Britain emerged from the war with by far the most powerful battleship and battle cruiser force in the world, although the United States now has under construction a formidable aggregation of major ships. England's Navy to-day includes 55 battleships and 9 battle cruisers less than 20 years old, with 4 powerful battle cruisers now under construction.

The United States has 36 battleships capable of holding a place in a modern battle line and not including a number of old type battleships listed for sale or the scrap heap. Thirteen of the most modern battleships in the world are under construction for the United States, and six battle cruisers are authorized and will be completed during the next three years.

Japan has 13 battleships and several battle cruisers completed and four battle cruisers under construction or authorized. Germany retains 30 battleships and one battle cruiser, most of which are of practically no naval value, and has two battleships and three battle cruisers laid down, on which construction has been stopped. France has 18 battleships and no battle cruisers completed and five battleships and four battle cruisers under construction.

The completion of the present building programs will find the following line-up of major ships: Great Britain, 55 battleships and 13 battle cruisers; United States, 49 battleships and 6 battle cruisers; Japan, 13 battleships and 11 battle cruisers; Germany, 32 battleships and 4 battle cruisers, still subject to the final naval peace terms, and France, 23 battleships and 4 battle cruisers.

Great Britain leads the world in cruiser and light cruiser strength, with a total of 118 vessels of these types, with 30 for the United States, 28 for Japan, 37 for Germany and 19 for France.—*The Naval Monthly*, Sept., 1919.

OPERATIONS

U. S. NAVAL FORCE LANDS IN DALMATIA.—The Navy Department on September 27 made public a cablegram from Rear Admiral Harry S. Knapp, U. S. N., commanding naval forces operating in European waters, saying that on September 23 a number of Italians surprised and captured Trau, a Dalmatian port in the zone assigned by the Supreme Council to be policed by American forces. A small landing force from the U. S. S. *Olympia* succeeded in recovering the town and preserving order there without bloodshed. Serbian forces were persuaded by Rear Admiral Philip Andrews,

U. S. N., commanding naval forces operating in Mediterranean waters, to take no action, Admiral Knapp's report states.

The subject of the landing of the American force was brought up in the United States Senate on September 29. As a result Vice President Marshall on October 2 sent to the Senate a communication from Secretary of the Navy Daniels, dated September 30, relative to the recent operations of U. S. Naval forces on the Dalmatian coast, which included a report from Rear Admiral Harry S. Knapp, U. S. N., commanding American Naval forces in Europe, who is stationed in London.

Secretary Daniels in his communication explains that the armistice line extends from Cape Flanka inland. North and west of this line Italian troops are in occupation. South and east the line is garrisoned by Serbian troops. This latter section of the Dalmatian coast is the headquarters of the American Naval forces, in which by agreement after the Armistice American Naval forces took charge of all one-time Austrian-Hungarian vessels found there and which has since been generally called American zone. The Americans have no forces on shore, but have extended a strong moral influence for the preservation of order and avoidance of a clash between Italians and Jugo-Slavs. There has been considerable friction along the armistice line between Serbians and Italians, but by the tactful firmness of Rear Admrial Philip Andrews, U. S. N., it has been kept from causing serious results.

On September 23 three truck loads of Italian soldiers in command of a captain crossed the armistice line and surprised and captured the small Serbian garrison at Trau. The Italian authorities informed the senior American officer present, Capt. D. F. Boyd, that the move was unwarranted and asked that the raiders be turned back. Captain Boyd sent a destroyer and two chasers to Trau at once, then saw the Serbian commander and got him to agree not to order an advance until he had an opportunity to get the Italians to withdraw. He sent Lieut. Commander R. S. Fields, U. S. N., and Commander Morony, of the Italian ship *Puglia*, by automobile to Trau and himself went in the U. S. S. *Olympia* to Trau. On arrival he found the Italians had been induced to return, leaving however, the Italian Army captain and three soldiers owing to breakdown of their truck. He landed a small guard from the U. S. S. *Cowell* and U. S. S. *Olympia* to see that no harm was done Italians and to preserve order pending the arrival of Serbian troops. He put the Italian army captain and three soldiers on an Indian motor boat and turned them over in charge of an Italian naval officer. Upon the arrival of the Serbian troops he withdrew the U. S. bluejackets, after receiving assurance that no violence would be offered civilians.

The Italian admiral, Milo, in command of ships and troops in Italian zone of occupation, sent the senior Italian officer present at Spalato to the U. S. S. *Olympia* with thanks for sending the Trau raiders back. He has brought the officer who commanded the raiding force to trial by court martial. The whole affair was most creditably handled and the prompt action of Captain Boyd, Secretary Daniels says, undoubtedly prevented a very serious incident which might have resulted in open warfare between Italians and Serbians. The landing was for the protection of the offending Italians left in Trau until adequate Serbian forces could arrive to preserve order.

The fact that the Italian authorities requested action of Captain Boyd, that he was thanked by Admiral Milo for his action and that Admiral Milo brought the offending officer to trial by court martial, Secretary Daniels states, all go to show that the raid was an isolated act of hotheads done in defiance of Italian authority, and that America acted in cooperation with the Italians to restore the situation. That no serious results happened is due to the prompt and efficient action of American forces, Secretary Daniels adds. Had they not so acted there would almost inevitably have been bloodshed, which would perhaps have resulted in a state of actual war between Italy and Jugo-Slavia owing to the intensity of feeling existing over the Dalmatian question.—*Army and Navy Journal*, Oct. 4, 1919.

MERCHANT MARINE

"LEVIATHAN" TO BE CHANGED TO AN OIL BURNER.—The *Leviathan*, it is learned on excellent authority, is to be converted in the near future from a coal to an oil burner. The change, it is claimed, will do away with no less than 300 firemen. This decision of the Shipping Board is in line with what most of the leading steamship companies are doing. The *Aquitania*, the largest of the Cunard liners, is to be converted to oil burning during the next few months. The Cunard Line's new passenger and freight vessels are all to be oil burners.

With the *Leviathan*, the largest ship afloat, converted to oil burning the development towards oil bunkers will undoubtedly be stimulated. She measures 54,282 gross tons and has steam turbines. She was launched in 1914 from the Blohm & Voss Yard, Hamburg.—*The Nautical Gazette*, Sept. 20, 1919.

1227 VESSELS DELIVERED.—A tabulation made by the Shipping Board shows a total of 1227 vessels delivered up to the week ending August 9. During that week 30 vessels, representing 97,550 gross tons (146,325 DWT) were turned over to the Shipping Board by the Emergency Fleet Corporation. The gross tonnage delivered to date is 4,542,278 (6,813,417 DWT).

During the month of July 108 vessels, aggregating 400,039 gross tons (600,058 DWT), were launched from yards under the control of the Shipping Board. A world's record in launching was established in July, 1918, when 124 vessels, of 423,167 gross tons (634,750 DWT), were sent overboard from Shipping Board yards. The launchings of July, 1919, were therefore only 16 less than the number launched during the record month of last year.—*United States Bulletin*, Aug. 18, 1919.

NEW MARINE SCALE FOR PACIFIC COAST ENGINEERS.—Marine engineers of the Pacific Coast received everything they asked for at the recent conference at San Francisco, the Atlantic scale being adopted without a struggle. The revised wage scale is retroactive to August 1 on all Shipping Board vessels dispatched from the Pacific Coast, regardless of whether or not a clause to that effect was inserted in the ship's articles. According to the agreement adopted, vessels are divided according to their size and power into five classes. Steel vessels produced in Portland all fall into class C. Wooden vessels built at Portland are of classes D and E. The scale adopted for the Pacific Coast and thus made uniform for all seaboards of the United States, follows:

	Class C	Class D	Class E
Master	$357.50	$343.75	$330.00
Chief engineer	332.50	318.75	305.00
First officer, first asst. engineer	228.75	222.50	216.25
Second officer, second engineer	200.00	193.75	187.50
Third officer, third engineer	176.25	170.00	163.75

The scale adopted for all vessels regardless of size and power includes the following wages: Carpenter, $105; boatswain, $95; able seaman, $90; quartermaster, $90; ordinary seaman, $65.—*The Nautical Gazette*, Sept. 13, 1919.

HOG ISLAND SHIPS RECORD.—Forty-one ocean-going carriers built at the Hog Island shipyard have steamed more than 336,192 nautical miles, carrying 425,000 tons of American products to foreign ports, according to figures compiled here. All of the vessels, turned over to the Shipping Board by the American International Shipbuilding Corporation since August 5, 1918, are registered at the port of Philadelphia, and 18 of the ships delivered their first cargoes from Philadelphia.

Accomplishing more than any other shipyard in the country to place the American merchant marine on the seven seas, the Hog Island yard has

launched 52 vessels, 11 of which will soon be delivered. Some of the ships have opened new trade routes between Philadelphia and South America, but most of them were used to carry foodstuffs to the stricken countries of Europe. Destinations of the 41 vessels include England, France, Italy, Germany, Japan, Brazil, Peru, Chili, Panama, Sweden, Norway, Finland, Batavia, Wales, Belgium, Buenos Aires, Colombo, Denmark, Cuba and the Verde Islands. The *Quistconck*, the first vessel delivered, has a mileage of 34,129 to its credit.—*The Nautical Gazette*, Sept. 13, 1919

ARMY TO RETAIN CERTAIN GERMAN LINERS.—Testifying before the House Military Affairs Committee General Peyton C. March, chief of staff, stated that in the allocation of the German ships interned in this country which this government refused to put into a general pool for distribution among the Allies, a number of the German liners will be retained permanently as part of the army transport fleet.

By obtaining a great number of these ships, others of which are to be put in the naval and merchant marine service of the United States, General March said that this country would never again be without sufficient transports, as was the case when war was declared against Germany.

General March said that the President, who held out against giving over the German ships interned in this country to a pool, had decided upon a policy of distribution among the different services. The detailed announcement, he said, would be made shortly showing how many ships will go to the army and the merchant marine. This government intends holding these seized German vessels as part payment for the submarine destruction to American commerce and lives.

According to General March, the army will get a great number of these ships which will not be needed constantly. When they are not used in the military service they will be leased to private corporations for commercial purposes, subject to the call of the War Department in case of any emergency.—*The Nautical Gazette*, Sept. 20, 1919.

WAR CHANGES IN MERCHANT MARINE.—Figures compiled by Lloyd's Register of Shipping show the changes which have taken place in the steam and sailer tonnage possessed by the various maritime powers between 1914 and 1919. Of the 27 countries listed in both years only seven now own more than one million tons of shipping as against 11 at the outbreak of the war. Germany, Austria, Russia and Sweden are the four nations which are no longer in the million-ton class. Nine countries show an increase in tonnage over pre-war times, the United States leading with a gain of 7,723,579 gross tons. Japan's merchant fleet grew by 616,880 tons, while that of the British Dominions was augmented by 264,121 tons. Brazil and Portugal show increases of 188,746 and 140,281 tons, respectively, the last-named country through the requisitioning of German ships having more than doubled the tonnage of its pre-war fleet. Steam tonnage changes were analyzed in our issue of last week. As far as sailing vessels are concerned, this class of craft constitutes now but one-seventeenth of the world's total merchant tonnage as contrasted with one-twelfth five years ago. It is true that the United States and seven other countries have added to their sailer tonnage during the war period, but in every case the increase has been very slight. On the other hand, Norway has lost more than one-half of her sailers, both as regards number and tonnage. Three-eighths of the world's sailing fleet flies the American flag. The only other nations possessing a considerable amount of sailing vessel tonnage are France and Norway.—*The Nautical Gazette*, Sept. 13, 1919.

SHIP BUILDING IN UNITED STATES AND ABROAD.—More than 2500 merchant vessels, aggregating over 8,000,000 tons, were under construction in the world's shipyards June 30, 1919. Before the world war the largest construction, 3,445,000 tons, reported June 30, 1913. The United States

is in the lead at present with nearly 1000 ships with a gross tonnage of 3,874,143, nearly one-third of which are wood.

To speed up production, the British shipyards are negotiating for an understanding whereby the employers agree not to place any limit on the possible earnings of workmen paid by results and the trade unions on their part, undertake to discontinue restrictions of output and that they will cancel any rules that limit output.

In Canada, for example, although water transportation is in its infancy, the government is building a large merchant marine in three types of ships at an estimated cost of more than $52,000,000.—*Engineering World*, Oct. 1, 1919.

NAVIGATION AND RADIO

WIRELESS COMMUNICATION'S ADVANCE.—Very few branches of science have received greater impetus in their development during the war than wireless telegraphy and wireless telephony. Those interested in the subject who have not been directly associated with its progress during the past four and a half years will be amazed when the veil of secrecy is lifted and they become acquainted with the efficiency of present-day apparatus.

They will be struck first of all by the appearance of compactness of the apparatus, and on being further initiated will find that the simplicity of operation amounts almost to a revolution of method.

When the war broke out wireless communication in the British Navy and Army was as effective as was possible at that stage in the progress of the art. As the war proceeded those in authority realized how vitally necessary it was in the interests of the services that every effort possible be put forward to design apparatus for wireless communication possessing qualities of increased sensitiveness, increased selectivity, and, if possible, assuring secrecy.

The needs of the air service presented a peculiar problem. At first it was necessary to establish reliable communication from machines in the air to units on the ground to which observers wished to transmit the results of their observations. Later it was deemed advisable to communicate messages by means of wireless from ground units to machines in the air cooperating with them.

When "formation flights" became the essential method of attack and defense, it was decided that efforts should be made to give the leaders of formations vocal command of their units. This was accomplished by improvements in wireless telephony, which proved so successful that flying officers could speak to others in machines flying near them, with as little effort and with as good results as if they were chatting in a drawing-room.

When long distance bombing raids began, wireless again came to the fore and provided a means of navigating machines without the necessity of making ground observations. At the time the armistice was signed, aeroplanes were being navigated by wireless with perfect accuracy independent of visual observations of any kind.

Wireless as an Aid to Navigation.—It may prove of interest to those connected with shipping to know how far these improvements may be employed to assist in the navigation of ships at sea, and to what extent their employment may tend to decrease the risk of disasters.

Ships can now be fitted with small wireless telephone sets, which would enable the commanders or navigating officers on the bridge of one ship to speak to officers on the bridge of another ship within the effective range of their sets (say 30 miles). The cost of the set would, without royalties, be so low as to be almost negligible. The advantages of such a service during foggy weather may be readily appreciated by those responsible for the safe navigation of ships. It is also possible at the present time to equip ships with direction finders capable of taking a bearing from a wireless transmitting station (either ship or shore) to within an accuracy of one degree at the normal range of the transmitting station.

By means of one of these direction finders the commander of a ship could navigate his vessel with absolute accuracy without any observations. It would enable him to set his course when approaching such points as the fastnet and innishtrahull with safety in a fog, thereby avoiding the possible loss of a good deal of costly time.

The best method of employing these instruments for navigational purposes would be as follows:

A small wireless telephone transmitting and receiving set should be installed in the wireless cabin of the ship and should be subject to a remote control through the medium of a change-over switch to the bridge. The wave length of 300 meters granted to all ships, but which is seldom if ever resorted to, could be used exclusively for telephone work, thus avoiding as far as possible interference with ordinary wireless work.

The special aerial rigged for use with the direction finder could be used for this set to a very good advantage. In fact, the direction finder apparatus itself could be used for the receiving side so that when voice signals were being received the direction from which they came could be indicated automatically.

During fog every ship fitted with telephone sets would send out a predetermined voice signal on a wave length of 300 meters at definite intervals, of, say, 13 minutes. Any two ships arriving within a distance of 30 miles of each other would thus indicate their presence. The respective operators would immediately take the bearing and obtain the course of the other ship and convey the full information to the bridge. If for any reason one of the commanders wished to converse with the other this could be done easily and effectively from bridge to bridge by means of the remote control. The instruments could be designed in such a manner that the effective range could be reduced to ten or five miles by the operation of a small switch. This would be for use in channels or other congested waters.

The direction finder, apart from its uses in connection with the telephone would be used extensively both in good and bad weather. When only dead reckoning is possible these bearings would materially assist the bridge whilst in good weather they would tend to show how far they were capable of being relied upon as well as giving the operators practice in taking them quickly and accurately.

Hitherto, wireless has played a very heroic part in the mercantile marine by obtaining assistance for vessels in distress. In the future it should be the aim of those responsible for its employment to use it as far as possible to reduce the perils of the sea. A far-sighted policy on the part of shipowners with regard to wireless would go a long way toward assisting those in command of their ships to navigate them safely. Considering the present possibilities of wireless as an aid to navigation, three-fifths of the accidents to ships at sea come under the heading of preventable losses.—*The Nautical Gazette,* Sept. 27, 1919.

RADIO TELEPHONE FROM HYDROAEROPLANE TO SUBMERGED SUBMARINE.—New London, Conn.—A radio experiment made on September 16 off New London in Lond Island Sound by the Experiment Station, Naval Station, established communication, both telephonic and telegraphic, between a hydroaeroplane flying 2000 feet in the air and a submarine submerged several fathoms in the water.

This was a demonstration for the delegates to the annual convention of the Edison Society of Electrical Engineers being held at Eastern Point.

It is said to be the first time than an aeroplane and a submerged submarine have communicated with each other directly, and is considered by naval officers here as an important factor in coast defense and in naval warfare.—*Aerial Age Weekly,* Sept. 29, 1919.

SHIP FOG GUIDING DEVICE.—According to the New York *Times,* Earl C. Hanson, an inventor of Los Angeles, had invented an auditory system for guiding ships in a fog, which, according to those who have examined the

apparatus, promises to make ocean travel free from all dangers of collision due to fogs, if further tests prove as satisfactory as previous experiments.

The new device is described as simplicity itself. A cable is laid in the center of the ship channel. Through the listening devices on board, the ship gives off a sound of certain pitch that cannot be mistaken for any other sound. The ship hugs the cable from harbor line to the dock. On the bridge and in the captain's cabin listening devices like telephone receivers are placed and attached by wires to the hull of the ship. The ship follows the course of the cable. Any variation away from the cable is indicated by visible indicators which show in feet the distance away from the cable and the ship is then put back over the cable by the steering rudder in the usual manner.

By the ear receivers the indicators may be confirmed at all times. Vessels going into port will use one cable; those coming out another. The sound on each is different and there can be no confusion and therefore no collision.

Along the cable at mile intervals a section is insulated with lead. Through this no sound can come and therefore the man on listening duty can tell instantly how far the ship has progressed, and by the cable chart in front of him can tell where the cable turns and where the ship must be steered to follow the curve of the cable and the center of the channel. The new device, according to those who have tested it and recommended its use, is as reliable as the telephone. It will work in all conditions of water and weather, it is said, and no amount of electricity in the air or powerful wireless currents about the ship can effect it in any way.—*The Nautical Gazette*, Sept. 20, 1919.

ENGINEERING

SOMETHING NEW IN CONDENSERS.—A new development in steam surface condensers is announced by the Wheeler Condenser & Engineering Co., Carteret, N. J. It is a patented "compartment condenser" that can be cleaned while in service without shutting down the turbine. Any tube or tubes may be temporarily plugged and other repairs made without taking the condenser out of service.

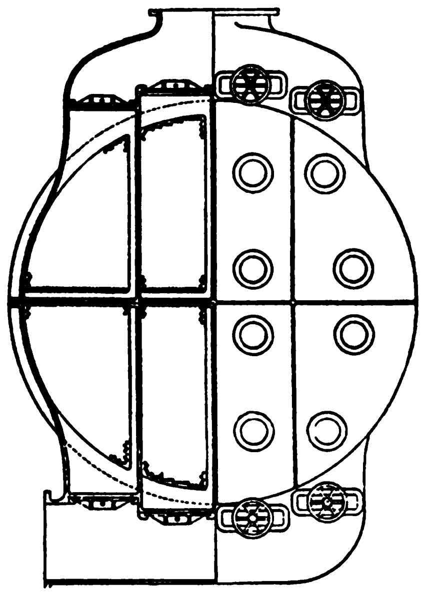
This is a timely development in view of the persistent claims made by well-known fuel authorities that the price of fuel is not likely to go down for some time if at all. This condenser will enable the chief engineer to constantly maintain clean condensers, hence a constantly high vacuum. All engineers of experience know that in addition to increasing output a high vacuum means low fuel consumption and a considerable saving in money year in year out.

Upon installation of this condenser, it is claimed there need be no interference with the operation of the turbine. At the present time, in many important power stations, even where water conditions are regarded as good, it is necessary to occasionally shut down the turbine for a period sufficiently long to give the condenser a thorough cleaning. In such cases, and in fact in all cases where continuous and highly efficient operation are desirable, this new type will fill a long felt want.

To clean the average condenser is not a difficult task, but it is time-consuming, and for that reason the chief engineer is naturally tempted to put cleaning off until "to-morrow," or "next week," or "next month." During his wait for the opportune time the vacuum gradually drops and, with the drop, coal wastage increases. Sometimes the loss of vacuum amounts to several inches of mercury, hence the compartment condenser which can be kept constantly clean regardless of load conditions, will in the long run prove to be a paying investment from the standpoints of both uninterrupted service and coal saving.

The illustration indicates clearly how the compartments are arranged. The condenser shown is divided into four compartments, each compartment being equipped with a set of valves to control the circulating water. To

clean the condenser while the turbine is delivering full power, the operator simply shuts off the water from one compartment, removes the cover, cleans the tubes, replaces the cover, turns on the water again, and then passes on to the next compartment repeating the operation until the four compartments or the entire condenser is clean. Thus, while one compartment is being cleaned, the other compartments are in full operation, temporarily taking over the entire turbine load.



WHEELER COMPARTMENT CONDENSER

An advantage that will not be overlooked by engineers in localities where water is bad is that no matter how severe the water conditions may be, the compartment condenser will take care of the cleaning problem. Shut downs for frequent cleaning will become a thing of the past. This condenser can be cleaned as many times per week or months as desired.—*Shipping*, Sept. 20, 1919.

TURNING AN AUXILIARY CONDENSER INTO AN OIL COOLER.—The S. S. *Anoka* of the American Hawaiian Steamship Company, which recently arrived in New York harbor from Portland, Ore., ran through very warm seas, the log book showing sea water temperature of 88 degrees day after day. This condition made it very difficult to keep the lubricating oil cool, especially as the boat was equipped with only one cooler. In fact the oil entered the cooler at 124 degrees and came out but one degree lower. As a result of the use of this hot oil the bearings of her turbines grew hotter and hotter, and at last, when they reached 164 degrees, the chief engineer, Arthur Sheridan, decided that something had to be done. Casting around for a remedy, he conceived the novel idea of transforming his auxiliary condenser into an oil cooler, and this he proceeded to do with the aid of such tools and piping as he had on board. The success of this plan was complete, as the oil temperature was immediately reduced to 103 degrees and the bearings kept in proper condition. After reaching port, Chief Sheridan boiled out the condenser with soda and kerosene and was ready for port operation.—*Scientific American*, Sept. 13, 1919.

PUTTING OUT A BURNING OIL TANK.—Oil and gasoline are risky things to store, and the insurance companies ask high rates on them, owing to the difficulty in extinguishing the flames by ordinary means if the storage tank should catch fire. The use of water results in a further spread of the blaze over a larger area on account of the well-known property of oil to float on water. The use of carbonic-acid gas is ineffective, because of the great diffusion in the atmosphere by the rising currents of air and other natural conditions. Both of these difficulties are reported as being remedied by a

A 55,000-BARREL TANK ON FIRE WITH A STRONG WIND BLOWING

PUT OUT IN 48 SECONDS BY CARBONIC-ACID BUBBLES

method which has been recently introduced into practical use. Says a writer in *The Engineering and Mining Journal* (New York, August 30):

"The process is based upon the principle of applying a froth or blanket of bubbles containing the carbonic-acid gas, which thereby concentrates the gas so as to make it most effective. It is also said that by this means, not only are the flames extinguished but the smoke and fumes are also smothered.

"Another advantage stated is the comparative dryness of the foam compared to water, as it possesses no tendency to soak into the material, which

results in less damage. The bubbles are minute in size and hold the gas efficiently. The composition of the solution used for the formation of the bubbles has not been revealed by the inventors. The froth resulting from the release of the liquid from the extinguisher is eight times in volume that of the original liquid, which therefore gives it a large area-covering capacity. The physical properties show the froth to be heavy, tenacious, and lasting. Portable means for the application of the method have been provided by the use of fire pails, hand extinguishers and portable engines. For large storage tanks permanent installations are used. The first illustration depicts a 55,000-barrel tank fire at its height, with a strong wind blowing, and the lower is an illustration of the same tank 48 seconds later, showing how the foam blanket smothered the blaze. The tank was 114 feet in diameter, presenting 10,200 square feet of surface. The method of projecting the liquid is shown by the two containers on opposite sides of the tank. The distance of discharge is a maximum of 50 feet."—*The Literary Digest*, Sept. 27, 1919.

CONDUCTING ALUMINUM—A NEW INVENTION.—A new invention called conducting aluminum M.277, which is said to be creating a profound impression, has been made by Dr. Georges Giulini, the most famous expert in aluminum trade. This new metal is produced by putting the ordinary aluminum through a special patented process, by which it acquires the same mechanical qualities and capacities as bronze, copper, and brass without changing its specific weight. It is said that the price of the new metal can be kept within very low limits; so that, even at the pre-war prices of other metals, it will be able, by reason of its smaller specific weight, to compete with copper and brass very favorably. The fact that the new metal is a conductor will make it especially in demand in the electrical trade. The inventor anticipates for it also a good market among the builders of motor cars, air-planes, ships, and railway carriages. Leading men to whom the invention is already known, are said to be much impressed with its possibilities.—*Scientific American*, Sept. 20, 1919.

NEW ELECTRIC BULBS.—There has beeen recently introduced a new form of electric bulb which possesses marked advantages over the usual bulb in fixtures where no special shade or other protection is afforded for the eyes. The outstanding characteristic of this lamp is the pleasing softness of its light. The large volume of light which the small filament emits is diffused to the point where the bulb itself appears luminous. The white bulb—it is milky white in appearance—is made in the 50-watt size, and notwithstanding the low brightness of the bulb, supplies more light than the 50-watt clear-glass bulb.—*Scientific American*, Sept. 20, 1919.

DIESEL ENGINE POWER OF THE FUTURE.—In a recent address before the American Society of Mechanical Engineers at Berkeley, Mr. E. N. Percy predicted that the Diesel engine would revolutionize American industry within a brief period. In part he said:

"The entire European maritime fleet is equipping its merchant marine with Diesel engines. Steamships cannot compete with motorships, and no country except the United States is now building steamships in quantity. The internal combustion engine possesses tremendous economic advantages over the steam engine. It requires only a third of present engine-room crews to operate, one-third of the fuel and its smaller bulk and cargo space fuel requirements afford far greater cargo space.

"Norway and Sweden are building 44 large motorships requiring 78 main Diesel engines. The East Asiatic Company, of Denmark, now has a large fleet of Diesel ships. The Scandinavian shippers are lifting steam engines from the holds and installing motors.

"Italy is now building a fleet of 8000-ton motorships. England is standardizing motorships of 8200 tons and 3300 horsepower. Eight of these vessels have been delivered, and a new one is launched every month.

"Prior to the armistice, Germany had evolved plans for an immense fleet of Diesel vessels and had a yard constructed with the foundation for eight shipways laid down.

"Twenty-five motorships equipped with Dutch Diesel engines of 4000 horsepower are now in active service. They have a tremendous cruising radius and some of them have run 300,000 miles with greater reliability and continuity than the average steamship.

"American firms for some years have been endeavoring to build semi-Diesels, light Diesels and high-speed Diesels with the result that Diesel engines have a very bad name in this country. They attempted to build a cheap engine.

"A reliable engine of this type is necessarily heavy and expensive, costing in the neighborhood of $150 per horsepower for the engine alone and $250 for the entire installation.—*The Nautical Gazette*, Sept. 6, 1919.

LIGNUM-VITÆ, THE VITAL WOOD.—The propeller shaft of every battleship, every destroyer, every transport, in fact, every large steamship, revolves in a wooden bearing at the stern end. Of all the thousands of woods in the world, true lignum-vitæ, a native of the West Indies and certain other parts of tropical America, is the only one that has been found equal to this exacting service. The peculiar properties which so well fit lignum-vitæ for the purpose are due to the arrangement of the fibers and the resin-content of the sap cells. The fibers never run straight up and down the log, but weave back and forth in a serpentine manner that cross and criss-cross like the corded fabric of an automobile tire. The result is a material of extreme tenacity and toughness. When the sap cells cease to function, their every nook and cranny become filled with a resin which is about a third heavier than water. The result is a material which weights about 80 pounds per cubic foot.

Stern bearings provide the most important use for lignum-vitæ but by no means the only one. Formerly it was in great demand for bowling balls, but now only one ball in ten is made of wood. A large quantity of low-grade logs, known as "cutting-up" wood, is consumed in the manufacture of rollers for furniture casters. Small round sticks made excellent mallets and fill a large demand, especially in Engand. Another important use is for sheaves of pulleys, and they have been known to last in constant use for 70 years. Another nautical application is for "dead-eyes," a small flattish block with a grooved rim to fit in the bight of a rope or encircled by an iron band, pierced with three holes to receive a lanyard, and used to extend the shrouds and stays. Among the miscellaneous uses may be mentioned stencil and chisel blocks, watchmakers' blocks, mortars and pestles, dowels, golf-club heads, wooden cogs, water wheels and block guides for band saws. In building the Panama Canal, the true lignum-vitæ made the most serviceable railroad ties that could be obtained. Between 150 and 200 tons of genuine lignum-vitæ are used every year in New York for fuel in grate fires. The very dense nature of the wood, together with the heavy resin content, produces a fuel with intense glowing heat and good lasting qualities. This provides one outlet for defective and crooked logs which are found in every shipment.—*Engineering World*, Oct. 1, 1919.

DEEP-WATER SPEEDS.—The new British destroyers of the "S" class, now nearly all completed, have reached some remarkably high speeds on their trials, well over the 36 knots for which they were designed. At least two of the Yarrow boats, the *Torch* and *Turquoise* have exceeded 39 knots. Curiously enough, however, the speed of 40.4 knots which the *Teazer*, of Messrs. Thornycroft, was reported to have achieved soon after her completion in July, 1917, remains the highest on record, but if this speed is accepted for purposes of comparison there is involved the question of the difference in trial courses. The *Teazer's* record was obtained on a run

between St. Catherine's Point and Ventnor Pier, and the Channel between these positions is shallower than on the deep-water course at Skelmorlie, over which the greater number of our destroyers have been tried during the war. There seems to have been an idea, in big ships, at least, that a higher speed could be obtained in deep water, as where the Channel was shallow the drag of the bottom affected the rate of speed of the ship. As far as destroyers are concerned, this is certainly not the case, for the highest speeds have been made in shallow water. The *Wolsey*, for example, loaded to 1188 tons displacement, made 38.2 knots in shallow water in the Channel, but on the deep-water course at Skelmorlie, loaded to 1206 tons (only 18 tons more), her speed was 36.6 knots, or over 1½ knot less. A similar result was obtained with the flotilla leader *Wallace*, completed after the armistice. Her builders, Messrs. Thornycroft, obtained permission to try her over the deep-water course at Skelmorlie, in order to ascertain the difference in performance as compared with that in 20 fathoms. Over the latter depth she realized 37.79 knots. Tried at Skelmorlie the next week, the speed, at the same loading, was 37.72 knots, but this was only obtained at an increased horsepower of 960. This bore out the previous experience that deeper water means slower speed.—*The Army and Navy Gazette*, Sept. 13, 1919.

RUST-PROOFING COATINGS FOR IRON AND STEEL.—The Bureau of Standards at Washington has issued a circular on a series of investigations concerning metallic coatings for the rust-proofing of iron and steel. The Bureau has studied a long series of methods to secure this result by means of metallic coatings, paint, lacquers, varnishes and enamels. The circular deals with the various types of metallic coatings, including those closely related in their nature and method of production, oxide and similar coatings. The methods of application and characteristics of the different metallic coatings are discussed, and it is shown that zinc, because of its electro-positive nature with respect to iron, is the one to be relied upon when protection against corrosion is the prime consideration. Other considerations, such as freedom from toxic effects in food containers, often lead to the choice of some other metal than zinc.

The circular discusses the structure and uniformity of distribution of the different classes of zinc coatings and their bearing upon the behavior in service. Of the various methods which are used for the testing of coated materials, the "salt spray" test is regarded as the most satisfactory. The articles to be tested are exposed to a fine mist of saturated salt solution, and the length of time they withstand this severe exposure is a fair index of the service life that may be expected for the specimen. This test while not entirely satisfactory, is the best which has yet been suggested, says the report.

A series of recommendations concerning the choice of protective metallic coatings for various types of works is given, together with a good working bibliography of the subject.—*Engineering and Industrial Management*, Aug. 28, 1919.

AERONAUTICS

REDUCING THE FIRE HAZARD IN THE AIRPLANE.—Fire is the greatest danger faced by the airman. Structural collapse, loss of control, collision, engine failure, bad landings—all these possibilities are serious, to be sure; but conflagration in mid-air is the one danger over which the airman has little control and still less chance of combatting, once it starts.

Various methods of reducing the fire hazard to a minimum have been worked out by British and French aircraft constructors, and many of the modern French airplanes are fitted with detachable or protected fuel tanks or tanks arranged with rip patches. In the case of the French airplanes, too, great care is taken with the gasoline, oil and water installations, in order to insure that installation failures should not provoke disasters. All air in-

takes have to be carried outside the engine fairing and so arranged that communication with the interior of the cowling is impossible, so that the risk from back fires is reduced to a minimum. Pressure fed gasoline delivery is forbidden. Ignition wires must pass under and not over the gasoline pipes.

The obvious thing to do with a flaming fuel tank is to drop it overboard. And so the problem of designing and constructing a fuel tank that could be instantly detached and released from an airplane at the will of the pilot has not failed to receive considerable attention. First in England, and later in France, actual tests have been carried out with encouraging results.

Various schemes have been worked out for detachable fuel tanks. Some depend on releasing a carriage which carries the tank, while others depend on the tripping of a latch. One of the French schemes for a detachable fuel tank is depicted in the accompanying illustration. The tank, in this case, is sort of wedge-shaped, and held in a wedge-shaped compartment by means of a simple latch device. The latch can be released from the cockpit, and the same operation shears all the pipe connections. Gasoline pipes coming from the gravity tank are previously closed off by a pet cock, or else automatically prevented from wasting fuel by a ball check valve.

As might well be expected, there are numerous objections to such an installation. The machine must be rearranged in most instances, resulting in some weaknesses. The fuel system must be altered, perhaps with detrimental results. The pilot is apt to release his tank without cause, due to nerves, resulting probably in a forced landing. In some cases, particularly the French Breguet bombers, tanks have become loose due to vibration. In a crash the detachable tank is just as likely to take fire as an ordinary tank. All in all, however, the detachable tank represents a distinct step forward in airplane design.

Then there are numerous schemes for protected tanks. The idea of covering a gasoline tank with India rubber originated with an Englishman, who took out a patent as far back as 1909. Various improvements have since been suggested, and a tank has finally been evolved which will take 20 or more incendiary bullets without leaking, and will not take fire even in a bad crash. One French inventor has developed a tank built of light steel with outer and inner walls, the intervening space being filled with glycerine and gelatine composition apparently similar to that which was at one time used as a filler for what were considered punctureproof tires. The composition is supposed to close and fill any hole made in this tank. However, the weight is so excessive that the tank has received little consideration.

Two French inventors have worked out a scheme calling for a steel tank of ordinary construction covered by a layer of felt and six or more layers of sheet rubber. One or more of the rubber sheets are separated by coarse interlaced hemp cord, and the whole constuction is bound in place by a galvanized wire netting. This tank has been provided with a funnel member at the bottom which gathers such fuel as escapes from the tank and percolates down through the layers of the cover. Tests have shown that this tank is fairly satisfactory, although its great weight is against it.

In the machines constructed in France for the United States Air Service, non-inflammable tanks were installed and at least one type of machine, namely, the Sopwith "Dolphin," was arranged for the non-pressure system. These tanks may be described as a semi-rigid type. Essentially, each tank consists of an inner metal shell of medium thickness, covered with fabric and layers of vulcanized rubber of varying degrees of elasticity and outer layers of fabric and a screen covering.

Practically all of the fireproof tanks in existence are based on the use of several layers of rubber or fabric in combination with metal. The idea is to accord a flexible construction which closes in after being perforated, and which can withstand severe shocks without breaking apart. Originally, the fireproof tank was intended wholly for fighting machines, and it is certain that if war had continued till this year, both sides would have employed

fireproof machines. As it is, the fireproof tank, both of the detachable and non-leaking types, has a decided peace application if airplanes are to be made safe.—*Scientific American*, Sept. 20, 1919.

THE FORMATION OF CLOUDS BY AEROPLANES.—As a result of certain observations it has recently been suggested that under favorable atmospheric conditions the passage of an aeroplane through the air can result in the formation of a temporary cloud more or less surrounding the machine. The creation of such a cloud appears perfectly reasonable, for given an appropriate degree of atmospheric humidity, it seems quite natural to expect that the local changes of pressure produced in the vortex and other disturbances in the air accompanying the flight of the machine would result in a temporary condensation of the atmospheric water vapor and the consequent formation of a "cloud." That the formation should be sufficiently marked to be observable at a distance, as apparently it has been observed, is we think, more to be wondered at than that the cloud should be formed. We learn that in the United States Army high-speed wind tunnel at Dayton the phenomenon has also been noticed on a small scale, and that it is being applied instead of the usual smoke or lycopodium powder method to make the flight vortices visible to the human eye and the lens of a camera.—*The Engineer*, Sept. 5, 1919.

LONG GLIDES.—What is believed to be a world's record for gliding with a dead motor was accomplished at Ithaca, N. Y., in a Thomas-Morse two-seater biplane. This machine flew to the head of Cayuga Lake, a distance of 35 miles, and having attained a height of 17,500 feet, the pilot switched off his motor and glided to Ithaca, at which point he still had 5000 feet altitude. If this glide had been continued it is estimated than an additional 15 miles could have been covered, making a total of 50 miles without the use of his motor. The longest glide previously recorded was that of Captain Raynham, according to *Aeronautics*, when he glided from Brooklands to Hendon, in England, a distance of 22 miles.—*Scientific American*, Sept. 27, 1919.

AEROPLANE TAKES OFF FROM SEA SLED.—The Navy Department conducted a series of successful tests of "taking off" from a sea sled. The plane was lowered from the deck of a battleship onto the sea sled. The sled got under way, gradually gaining full speed. Then the aeroplane engine was tuned up to full speed. The plane rose straight upward as if thrown from a catapult. The test was repeated several times with great success.—*Aerial Age Weekly*, Sept. 29, 1919.

MOORINGS FOR AIRSHIPS.—The mooring out of airships is a problem, writes Colonel W. L. Marsh in the London *Times*, of extreme importance. The first attempt in this direction was made in September, 1911, when his Majesty's naval airship *Mayfly* was brought out of her dock and moored to a mast on the Cavendish dock, Barrow-in-Furness. This mast was mounted on a raft and left free to swing with the wind. Attached to it was a screen in the form of a lattice made of rope to break the force of the wind.

The next development was a steel lattice-work mast. In this case, the top of the mast was a revolving cone, with its axis horizontal to the ground, into which the nose of the airship was led and securely fastened. Non-rigid airships tend to ride forward into the mast, and this, while being free to revolve, must be rigid. The envelope, however, must in some way be strengthened to resist the alternate pull and push of the anchorage. The ideal place for the attachment is the extreme point of the bow, but this is apt to break the nose-stiffeners which are fitted to reimburse the bow against the wind pressure in flight.

A mast has now been evolved comprising a vertical member at the top of which is a revolving pivot on a universal joint, carrying two horizontal

arms forming a complete semi-circle. At the extremity of each of these arms is a circular disc, in the center of which is a hoop on the end of a wire rope. Corresponding to these two discs are two fabric rings, with a hoop in the center of each, on either side of the bow of the airship.

In this way the airship is firmly held by the two arms while being left free to revolve like a weathercock in accordance with changes in the direction of the wind. The universal joint allows a certain amount of play and allows the airship some latitude for a pitching motion. The chief function of the two arms is to prevent rolling, which was bound to be considerable when only one point of attachment was used.

In the case of rigid airships, the problem is in reality simpler, as it is comparatively easy to reinforce the nose. Messrs. Vicker's method is to fit a stout steel bar to the nose-cap of the airship. This has a ball on the end, which by an ingenious device, automatically dips into a cup fitted in a universal joint on the top of the mast.

On landing to a mast the airship will be brought down to a height of about 200 feet and as close to the mast as possible with her head to the wind. The trail rope will then be dropped and attached by a spring clip to a hawser from the mast. The airship will then be hauled up to the mast by a winch until the steel ball meets the cup on the mast. The cup automatically closes, locking the airship fast, and the trail rope will be cast off from the hawser, the ship remaining attached simply by the grip of the cup. In this way, it is estimated that a large rigid airship could be landed with the assistance of not more than half a dozen men, thus doing away with the present landing parties of 250 men.—*The Nautical Gazette*, Sept. 20, 1919.

SOARS TO 34,200 FEET.—Roland Rohlfs soared to a new world's altitude record in his Curtiss *Wasp* at Roosevelt Field, Mineola, September 13. Rohlfs flew to a height of 34,200 feet, but because there were no officials present to seal his instruments the record is not official. The aviator is confident, however, he can repeat or better his performance under official auspices and promises soon to make a try at it.

The standing official altitude record is 38,136 feet, credited to Adjutant Casale of the French Army. In July, Rohlfs made an official flight of 30,700 feet. He was prevented from flying higher on that occasion by the chilling of his motor. Since then shutters have been fitted on the *Wasp's* radiator. Rohlfs's observations during the flight of September 13 disclosed a "temperature lid" at 34,000 feet. At that altitude his thermometer registered a minimum of 44 degrees below zero. Then it began to grow warmer, showing 40 degrees below at 34,200 feet.—*Aerial Age Weekly*, Sept. 22, 1919.

BAKELITE PROPELLERS UNDER TEST.—During the past few years there has been developed for various electrical uses, and also for certain parts of automobiles, a composition material called "Bakelite," after its inventor, Dr. Bakeland. So successful has this material proved that experiments are now being made with aeroplane propellers built of it. From the results thus far obtained, it is evident that these propellers have several advantages over those constructed of wood.

Bakelite is a harmless and particularly inert composition material derived from the combustion of carbolic acid, cresol, or phenol, and formaldehye. These, when combined in the proper manner, form a resin, which in its primary state may be either solid or fluid, but in either case is essentially a soft resin easily affected by heat and solvents. If subjected to combined heat and pressure for a sufficiently long time, however, the material is carried over into a hard state not affected by the ordinary solvents to temperatures that ordinarily would disintegrate a gum or resin. When in this condition bakelite is but slightly affected by acids or weak alkalies. It will not burn at all readily, but will char and burn slowly at temperatures in the region of 300 degrees to 400 degrees C.

Flat sheets of cloth or paper are coated with bakelite and pressed together to form solid blocks of various shapes.

The material, formed by coating a cloth or paper base with bakelite compound and pressing a number of these prepared sheets into a solid block, is known by the trade name of Micarta.

Wooden aeroplane propellers are subject to warping, splitting at the laminations, chipping, etc. Moreover, the various laminations in any one propeller are rarely of exactly the same moisture content when assembled, and their density also varies. This results in unequal absorption of moisture, particularly in cold weather.

Propellers made of micarta are practically impervious to moisture. They are also, if properly made, much more uniform in structure and are practically as strong as wood propellers, but slightly heavier.—Technical supplement to the *Review of the Foreign Press*, Aug. 19, 1919.

British Reduce Their Airship Program.—A surprising development of the past year was the enormous scale upon which Great Britain launched her new aviation program. The proposed expenditure, which totalled the enormous sum of over $300,000,000, covered several airships which were to be larger and faster than anything that had yet been attempted. In addition to the governmental enterprises several large syndicates were formed for the purpose of promoting local, long distance and world travel, and the plans of these corporations, in the world both of finance and engineering construction, bordered on the sensational.

Since the announcement of these enterprises was made, strong pressure has been brought upon the British Government to exercise an all-around economy, and the pruning knife has already been taken in hand with most drastic results. In our last issue we showed what was being done in reducing the size and running expenses of the British Navy, 150 of whose ships have been condemned and stricken off the list, including practically the whole of the pre-dreadnought fleet. It is evident that the airship program is being cut down with an equally ruthless hand. The Air Ministry has decided to sell to private aviation firms a number of airships and also several airship stations, together with a large amount of stores.

That the curtailment is very severe will be realized when it is mentioned that among the numerous large airships to be sold is the one known as *R-80*, which has been nearly completed by Messrs. Vickers, and the huge *R-39*, which is being built by the Armstrong firm. Although the exact dimensions are not available *R-39* is much larger than any airship in the service, including the famous *R-34* which recently made the successful round trip from England to America and back. The government is so much in earnest in this matter that, if it is not possible to find purchasers, some of the airships, because of the heavy cost of maintenance, will be demolished. It is probable that those ships whose construction has not advanced very far will in any case be broken up. The necessity for cutting more deeply into airship program than into that for airplanes is due to the enormous first cost of the necessary landing grounds, air sheds and mooring posts which, so far as the air sheds alone are concerned, practically doubles the cost of each ship.

We are told that probably purchasers for several of the airships will be the syndicate which has been formed to establish air service between Liverpool and New York and between Liverpool and Australia, for if these services are to be maintained with any reasonable frequency and regularity, at least six of the larger type of airships must be built or purchased.

Of course we were all aware that the high first cost of the airship was a serious handicap; but it is not so well understood that its life is very limited. In the hearings before the House Naval Committee, its useful life was given, if we remember rightly, as about two years. That, of course refers to the machines of to-day, and is due chiefly to the perishable nature of the canvas covering. In any case those who pin their faith to the heavier-

than-air machines will feel that this drastic action of the British Air Ministry has discounted to some extent the airship and put a premium upon its smaller rival.—*Scientific American*, Oct. 4, 1919.

MISCELLANEOUS

SUBMARINE SCRAPPING.—After the destroyers, the submarine. Our present strength in under-water craft is not known exactly, but after the heavy toll of war losses, amounting to 54 vessels, it is manifest that the Admiralty order placing another 52 boats on the same list means drastic reduction, especially as we know now from Lord Fisher that when he returned to office in October, 1914, there were only 51 submarines in the whole service. Yet the reduction cannot be considered a bit too sweeping. In submarines, perhaps more than any other class, enormous developments must take place before the next naval war, and the service should not be encumbered with a lot of obsolete material, the retention of which could only lead to waste in money and men. The surprising thing is that 10 months should hav been allowed to elapse after the armistice before the scrapping of such old and small submarines as the 26 of the "B," "C" and "D" classes which appear in the new list. If these classes, *vide* Lord Jellicoe, were unfit for oversea work in 1914, they certainly must have been even more unfit in 1918, and they were surely not retained merely for coastal duties. Having at length moved in this matter the authorities have also included submarines of six later classes, several of them built during the war. The post-war flotillas will henceforth be composed entirely of vessels completed since 1914. The oil driven "J" and "L" types, and steam driven "K" class will form the backbone of the flotillas, with a proportion of older classes from the later "E's" onwards.—*The Army and Navy Gazette*, Sept. 20, 1919.

CIVIL ENGINEERS WANTED IN NAVY.—Young civil engineers who desire to become officers in the U. S. Navy have an excellent opportunity to secure an appointment in the grade of assistant civil engineer to fill existing vacancies. Appointees will be commissioned with the rank of lieutenant (junior grade), and there are at least 18 vacancies at present. A candidate who has passed his thirtieth birthday on December 15, 1919, or who has passed his twenty-first birthday on that date, will not be eligible for examination. The examination is open to all citizens of the United States, including reserve officers, temporary officers, and enlisted men of the navy who comply with conditions. The candidate must have received a degree from a college or university of standing, showing that he has satisfactorily completed a course in engineeering, and must have had not less than 16 months' practical experience since graduation. The Navy Department reserves the right to waive deficiencies as to age in the case of any officer who has satisfactorily performed duties in the Civil Engineer Corps during the war period. A descriptive circular will be sent to all persons interested upon application to the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C.—*Army and Navy Journal*, Sept. 27, 1919.

GERMAN NAVY.—Berlin "Navy Orders" contain details of the new uniform to be introduced into the German Navy on November 1. The letters "S. M. S." (his Majesty's ship) will disappear from the men's cap-bands. Gilded buttons without the crown are to be worn, and a dagger will be the only weapon carried. The different colors of the velvet collar of officers' and warrant officers' uniforms, denoting the various branches of service, are to be done away with. The ranks of officers, pursers, and warrant officers will be shown by gold arm stripes, differing in number and width. Epaulettes are being abolished, but greatcoats will have shoulder-straps bearing the badges of rank. The wearing of the uniform is compulsory on duty only.—*The Army and Navy Gazette*, Aug. 30, 1919.

THE ALLIES ON THE RHINE.—The strength of the Allied Army of Occupation on the left bank of the Rhine has, it is announced in the Paris press, been fixed at 150,000 men, of which number France will find half. The remaining 75,000 will, it is stated, be found by Great Britain, Belgium and the United States. Belgium, as a conscription country, will probably find the biggest contingent, for under any system of voluntary service numbers are always a difficulty. M. Clemenceau stated recently before the Committee of the Chamber on the Peace Treaty, that the occupation will be for a maximum period of 15 years, and that the left bank and the right bank of the river for a depth of 50 kilometers will be completely demilitarized. With the German Army for the rest of the Empire reduced to 100,000 men it would seem that there is every prospect of the provisions of the Treaty being carried out.—*The Army and Navy Gazette*, Sept. 6, 1919.

MILITARY TRAINING FOR NEW YORK BOYS.—The work of calling up more than 100,000 boys in the state of New York who are 16, 17 and 18 years of age for military discipline and citizenship training was commenced October 1 by the State Military Training Commission, of which Major General John F. O'Ryan of the New York Guard, and who commanded the 27th Division, A. E. F., overseas, is chairman. Training is to begin immediately in all parts of the state under regular army and state guard officers and male teachers and physical instructors of various schools and colleges. The Bureau of Technical Military Training, in charge of Brig. General William H. Chapin, has direct charge of the training program. The state law makes it necessary for every boy of the ages mentioned to possess a certificate issued by the commission showing that he is meeting with the legal requirements. No school may permit a boy to attend unless he has a certificate and no employer may continue to employ a boy unless similarly provided.—*Army and Navy Journal*, Oct. 4, 1919.

PROPOSED JAPANESE-PACIFIC CABLES.—A recent dispatch from Tokyo states that prominent Japanese business men have decided to float a company with a capital of 50,000,000 yen (about $25,000,000) for the purpose of laying a cable line between the United States and Japan. This decision is the result of dissatisfaction which has been existing for a long time among business men on both sides of the Pacific with the present cable service, which seems unable to handle the constantly increasing volume of traffic.

It is expected that the venture will be supported by business men of the United States as well as by those in Japan, and that the establishment of a new cable line will do much towards promoting trade between the two countries.

"Some time ago a committee of business men formed to look into the matter of laying a cable between the United States and Japan," said K. Uchida, former Vice-Minister of Communications, who is the moving spirit in the proposition.

"It has not been decided as yet what route will be chosen for the cable, but we know it will be one of the two southern routes. One of these will run from San Francisco to Hawaii, to Midway, and to Ogasawarajima. The other will be the same with a substitution of one of the South Sea Islands, now under control of Japan, in place of Midway. The Hawaii route is the shorter, but the other gives a shorter distance between stations, which will enable it to do speedier work. No final decision will be made as to which of the two will be chosen until after a survey has been made."—*The Nautical Gazette*, Sept. 20, 1919.

CHINA BUILDING SHIPS.—In these days of planning for commercial prestige, even the Chinese are building ships. At Shanghai is a shipyard, the Kiangnan, operated by the government, which is turning out ships regularly, even though its capacity is limited, and the methods employed in many instances are antiquated.

Chinese directors are in charge of the plant, though the engineering problems are superintended mainly by Englishmen. The workmanship appears to be of high quality, and the vessels of the composite type which are constructed there are insured by Lloyd's for 20 years. In the last 10 years an average of 31 vessels a year have been turned out. Many have been for the use of the American Government in Philippine waters.—*N. Y. Times,* Oct. 5, 1919.

POLAND TO HAVE A NAVY WHEN TREATY IS RATIFIED.—The organization of a Polish Navy, to become operative with the ratification of the Peace Treaty, is proceeding rapidly, according to advices from Polish sources. The fleet will consist, according to present plans, of four armored cruisers and 12 large torpedo-boats. It will have a personnel of 3500, including 150 officers, probably under the command of Admiral Porebski.—*N. Y. Times,* Sept. 20, 1919.

JAPAN'S NAVY MANEUVERS.—Coincident with the return of the Emperor and Empress from Nikko, it was announced that extensive naval maneuvers would be carried out by the entire Japanese Navy, with the exception of ships in distant waters, in the Pacific Ocean off the Southeastern coast of Japan, beginning the middle of October.

The maneuvers will be under the personal supervision of the Emperor, this being the first time that he has been in charge of evolutions on the high seas. It is understood Japan will appropriate $125,000,000 for aviation, the program to be extended over four years.—*N. Y. Times,* Sept. 28, 1919.

CHASERS RACE FROM BERMUDA.—Six submarine chasers, 110-footers, on their way from foreign bases raced from off St. Davids Head to a line off the Statue of Liberty and made a fine contest. Vice Admiral Morgan Singer, R. N., sent the racers away at five o'clock on Saturday afternoon, August 16. The Admiral and his party were on the government tub *St. Abbs* and a large fleet of vessels of all types went outside to see the chasers start.

A tender, *Hannibal,* left Bermuda 24 hours before the race started and she was passed by the leaders 36 hours after the start. Lieutenant Joseph L. Day of Portland, Me., had charge of the *S. C. 131* and he succeeded in getting his vessel first across the line and maintaining the lead all the way. The Ambrose Channel Lightship was hailed at at 2.19 o'clock on Tuesday morning, August 19, and the finishing line was crossed at 2.53. The actual time from start to finish, allowing for difference in time, was 57 hours, 20 minutes. The *S. C. 217* finished at 3.01 o'clock and *S. C. 351* at 3.34 o'clock. *S. C. 90, S C. 224* and *S. C. 237* followed in the order named.

Lieutenant Day said, "We ran into what was rough water for us right at the start, which held until we reached the Gulf Stream the next day. Going with the current we found practically smooth seas in what we expected would be a nasty spot. On Monday the weather was fine until evening, when the racers ran into fog and later they raced through a terrific electrical storm. It was hard work to pick up the Navesink Light, but we did so finally at 11.30 o'clock."

The best previous record over this course but going to Bermuda was made by the *Ailsa-Craig* in 1907. That yacht, with a 100-h. p. Craig engine, made the 42 nautical miles in 64 hours, 21 minutes. The 110's have three Standard engines of 225 h. p. each.—*The Rudder,* Sept., 1919.

100 OFFICERS AND SAILORS OF NAVAL SHIP DIE IN TYPHOON.—Lining up on the deck and crying "Banzai!" more than 100 officers and seamen of the Japanese naval oil supply ship *Shijiki Maru* went down with their ship in a typhoon off the Island of Kyushu.

According to the stories of eight survivors, the *Shijiki Maru* ran on the rocks during the typhoon, and in a dense fog. Warships are engaged in the search for possible survivors, who may be found on the island.—*N. Y. Times*, Sept. 11, 1919.

THE FIRST SUBMARINE VICTIM.—In the course of his extremely interesting narrative of the Dover Patrol in the *Daily Telegraph*, Admiral Sir Reginal Bacon mentions that the submarine menace made a heavy call on our available destroyers, "especially when such vessels began indiscriminately sinking merchant vessels on October 21, 1914." The country may not remember that it was so early in the war that Germany began destroying merchantmen in this way. The first submarine blockade was not proclaimed until February 18, 1915, but for four months the "U"-boats had been trying their hands at the new game of piracy. The promptness with which this method of commerce destruction was taken up, as soon as boats were available for it, shows clearly that it was premeditated, but the earliest sinkings attracted little public attention and no one could have foreseen the lengths to which the submarines would go. Although, as a calculated insult, it was intended to sink the first British merchantman on Trafalgar Day, the incident actually occurred on October 20, 1914, the news reaching England next morning. It was the steamer *Glitra*, of 866 tons, owned by Messrs. Salvesen, of Leith, and commanded by Captain R. E. Johnston, which was destroyed, *U-17* lying in wait for her while she was bound with a general cargo from Grangemouth to Stavanger. The submarine flew the German flag and the *Glitra* tried to escape, but her speed was too slow and she therefore complied with the signal to stop.—*Army and Navy Gazette*, Sept. 20, 1919.

SKODA WORKS NATIONALIZED; CZECHS AND FRENCH TO DIRECT.—The famous Skoda arms and ammunition works, near Pilsen, have been nationalized, according to messages reaching here. A new council has been named to conduct the works, comprised of six Czechs and three Frenchmen.

The last previous advices regarding the Skoda works were that their purchase was being negotiated for by an American syndicate. A Geneva dispatch on August 31, however, said that there was a hitch in the negotiations due to the differences on the question of the price to be paid.

The Skoda works produced the famous Austrian howitzers, one of the most effective heavy artillery weapons used by the Central Powers in the war.—*N. Y. Times*, Sept. 29, 1919.

MAKING SAFE THE HIGH SEAS.—One of the most welcome signs of peace for those who travel the high seas, has been the removal from merchant ships of guns, gun platforms, lookout-nests and the bizarre camouflage and their restoration to peace-time conditions. Not only does the passenger embark on a ship which has been restored her external grace and internal comfort, but she can steam on a direct course for her destination without fear of the bursting shells of the enemy raider, or the rending of her hull by a torpedo.

Not all of the war terrors were swept away, however, with the signing of the armistice; for, although the enemy might no longer sow the seas, the roadsteads, and the channels of maritime commerce with the deadly mine, the seas as he left them, were full of this peril. The Allies, of course, did their own share of mine planting; but since they possessed the charts of the mine-fields, the peril was limited. The enemy also was required by the armistice to furnish full plans of his activities.

The work of mine removal has been a simply stupendous task, the largest part of which was the clearing away of the great mine barrage, 250 miles in length, which was laid by our own and British navies. The greater share of the task, involving the laying of between 50,000 and 60,000 mines, fell to

us, and to us was allotted the task of their removal, which in its way, was scarcely less full of peril and less burdensome than the work of putting them down. However, according to dispatches from London, the work has now been completed and we are given credit for its rapid accomplishment. Unquestionably, our North Sea mining operations, including manufacture of the mines in this country; their transport to Scotland; the formation of a great mine laying fleet; the laying of the mines and their remarkably speedy removal, will always be set down as one of the major operations of this great war.—*Scientific American,* Oct. 4, 1919.

WANTED—A BOLIVIAN PORT ON THE PACIFIC.—The government of Bolivia has made a demand on the League of Nations for an outlet to the Pacific. The Port of Arica, the terminus of the Trans-Andean railroad from La Paz, the Bolivian capital, is the port most desired. This port belongs to the Peruvian provinces of Tacna and Arica, which were seized by Chile in a dispute with Peru in 1883.

Arica is connected with the city of Tacna, the capital of the province of that name, as well as with the Bolivian capital. Formerly it was the exporting center for a large number of Andean mining camps, silver, copper and maganese ores being shipped in large quantities. Now, it chiefly handles the exports of Bolivia. These consist chiefly of chinchilla skins, alpaca wool and other agricultural products. Loading and unloading of vessels is effected by lighters in an open roadstead behind the island of Alacran. The trade of the port has not yet rendered it necessary to go to the expense of constructing breakwaters and forming an artificial harbor.

Although the Bolivian Government has filed a claim for the port of Arica, it does not expect action to be taken until the pending dispute between Peru and Chile with respect to the provinces of Arica and Tacna is settled. According to the terms of the settlement of the war between these two countries, Chile had to restore the provinces to Peru, but now that the time to do so has arrived, the Chilean Government refuses to relinquish its hold. It has, however, agreed to refer the dispute to the peoples of the provinces. Meanwhile Bolivia is permitted to use the port of Arica freely. Its trade is prospering, according to latest advices.—*Shipping,* Sept. 27, 1919.

CURRENT NAVAL AND PROFESSIONAL PAPERS

The Low Visibility Phase of Protective Coloration. By Loyd A. Jones. *Journal of the Franklin Institute,* Sept., 1919.

Radio Direction Finding Apparatus. By A. S. Blatterman. *Journal of the Franklin Institute,* Sept., 1919.

The U. S. Navy Transatlantic Flight. By Henry Renterdahl. *Scribner's Magazine,* October, 1919.

Our Restored Merchant Marine. By T. M. Knapper. *Review of Reviews,* October, 1919.

Universal Training for National Service. By John Erskine. *Review of Reviews,* October, 1919.

The Victory at Sea. II. The Adoption of the Convoy. By Rear Admiral William S. Sims, U. S. N. *World's Work,* October, 1919.

Results of the Blockade Upon Germany. By Alonzo C. Taylor. *World's Work,* October, 1919.

The German Conception of the Freedom of the Seas (Extracts from German sources). By Amos S. Hershey. *American Journal of International Law,* April, 1919.

The Strategic Value of Shantung. By Arthur Judson Brown. *Asia,* October, 1919.

How Tirpitz Ruined the German Fleet. By Captain Persius (translated). *Journal of the Royal United Service Institute,* August, 1919.

The Influence of the Submarine in Naval Warfare of the Future. By Lieutenant W. S. King-Hall, R. N. (Prize Essay). *Journal of the Royal United Service Institute,* August, 1919.

The Beginnings of Submarine Warfare. By Col. C. Field. *Journal of the Royal United Service Institute,* August, 1919.

Belgium and Holland and the Freedom of the Scheldt. By Emile Cammaerts. *The Nineteenth Century and After.*

The Grand Fleet (A Study of Operations including Jutland). By Captain Romeo Bernotti. *Rivista Marittima* (Italy).

ANNOUNCEMENTS

Chas. Cory & Son, Inc., main office & factory at 290 Hudson Street, New York, N. Y., have announced the opening of a new branch at 207 Market Street, Philadelphia, in order that their ships' electrical installation and repair, and mechanical communicating work may be more expeditiously handled in the Philadelphia district. The Cory Company announces that it will carry in its Philadelphia branch a complete stock of marine electrical appliances and mechanical communication apparatus which will be available for immediate deliveries.

Mr. H. W. Philbrook, formerly with the General Electric Company of Schenectady, has been appointed district manager of the Schutte & Koerting Company's New York office, 50 Church Street. The Schutte & Koerting Company have lately issued a pamphlet entitled "Our Part in the War," and will take pleasure in mailing a copy to those applying for same.

DIPLOMATIC NOTES

FROM SEPTEMBER 15 TO OCTOBER 15

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

RATIFICATION OF THE PEACE TREATY

FRENCH CHAMBERS RATIFY TREATY.—Following the ratification of the Peace Treaty by the French Chamber of Deputies, the French Senate opened debate on the treaty October 7 and ratified both the treaty and the Franco-British and Franco-American agreements on October 11 by a large majority. The ratification of the treaty by Great Britain and France left it necessary for only one other of the great powers to ratify in order to put the treaty into effect.

KING OF ITALY ISSUES DECREE APPROVING TREATY.—On October 7 King Victor Emanuel of Italy issued a decree authorizing the government to execute the peace treaties with Germany and Austria, and at the same time setting forth that the decree be presented to Parliament to be converted into law. Since elections for Parliament take place in Italy on November 16, and since the new Parliament will not meet until December, Italy's ratification of the treaty cannot be completed until that month.

EMPEROR MAY RATIFY FOR JAPAN.—Paris, October 8.—Ratification by the Japanese Parliament of the German Peace Treaty is not required by the Constitution of Japan, according to information from Peace Conference circles. Signature by the Emperor after consultation with the private diplomatic council constitutes the necessary ratification, and this is expected to be effected by October 15.

If two others of the five great powers have communicated the official announcement of ratification to the French Foreign Office by that time, or if the governments of France and Great Britain have joined the sovereign of Italy in completing the forms of ratification before, a *proces verbal* will then be drafted by the French Foreign Office stating that the documents have been deposited there, and the date of this document will be that on which the treaty will come into force.

The state of war will be at an end from the date of the *proces verbal*, and, with the reservations stipulated in the treaty, official relations will then be resumed between the allied and associated powers and Germany.

Directly after the Versaills Treaty has come into force, the Council of the League of Nations is required to meet in order to intervene immediately in a certain number of urgent questions, such as the appointment within a fortnight of members of the commissions to delimit the frontiers of Sarre district and Danzig.—*N. Y. Times*, 9/10.

PEACE TREATY DEBATE IN U. S. SENATE.—On October 2 the Fall Amendments to the Peace Treaty, which would have barred American representation on the various commissions created in the document, were defeated by a vote in which those opposed to the amendments received a majority rang-

ing from 5 to 10 over those in favor. On October 16 the Shantung Amendments, providing for the transfer of Japan's privileges to China, were defeated by a vote of 55 to 35.

During the week ending October 12 insistent efforts were made by "middle ground" senators to persuade Democratic leaders to agree upon compromise reservations to the Leage of Nations Covenant, in order that the entire treaty might not be defeated. The administration senators held out against any compromise that involved sending the treaty back to the Peace Conference, and threatened themselves to vote against a ratifying resolution in which "killing reservations" were made.

GERMANY

ALLIES INSIST ON EVACUATION OF BALTIC PROVINCES.—In the third week of September the Paris Supreme Council sent a note to Germany renewing its demand that German troops evacuate Courland and other Baltic provinces formerly a part of Russia. In reply on October 5 the German Government stated that it had recalled General von der Goltz, commander of the German troops in the Baltic provinces, had stopped pay, supplies, and munitions on September 25, and had thus exhausted its means of coercion. It suggested that an Allied commission should be sent to the Baltic to verify these facts. On October 10, Marshal Foch was directed to renew the Allied demand and to place upon the German Government entire responsibility for its execution.

German reports of the same date stated that the greater part of General von der Goltz's army, variously estimated to number from 35,000 to 60,000, was leaving the provinces. But on October 11 came news to the effect that German forces in cooperation with Russians had occupied the port of Riga and compelled Lettish troops to evacuate the city.

GERMANY GIVES UP AUSTRIAN UNION.—Paris, September 21.—Baron Kurt von Leersner, President of the German Peace Delegation at Versailles, to-morrow afternoon at 4 o'clock will sign the protocol annulling Article 61 of the German constitution, as demanded by the Peace Conference. The signing will take place at Versailles and will be private. Jules Cambon of the French Peace Mission will be the only Allied representative present.

Article 61 of the German constitution would have given Austria representation in the German Parliament. The Supreme Council declared that this provision was contrary to the stipulations of the Versailles Treaty.—*N. Y. Times, 22/9.*

ITALY

D'ANNUNZIO AT FIUME.—On September 13, Gabriele d'Annunzio, the poet-aviator, entered Fiume with about 2300 troops and 40 motor lorries, the 6th Italian Army Corps which was in the city refusing to prevent his entry and for the most part joining his undertaking. General Badoglio, Deputy Chief of Staff of the Italian Army, was at once sent to Fiume with full powers, but failed completely to bring the troops within the city under government control. The French and British garrisons for the most part withdrew on September 15.

Upon news of the Fiume coup, Foreign Minister Tittoni at once returned from Paris to Rome. The Italian Government condemned the action of the rebellious troops, and instituted a blockade of Fiume. On October 4, however, food was allowed to enter the city, and only a loose military blockade was continued. D'Annunzio's forces at the time numbered from 25,000 to 30,000, occupying the city itself, the Jugo-Slav suburb of Sussak, and the country behind it a distance of about six miles. Though on the verge of hostilities with the Jugo-Slavs, the Italian leader early in October issued a message to the effect that while the Adriatic was "an Italian sea," the Slavs would be conceded full commercial privileges.

Italy's Policy Dependent on Coming Election.—On September 29 the Italian Parliament was dissolved, the new Parliament to assemble about December 1 following elections on November 16. In the interim it was believed that the Nitti Cabinet would hold over and take no decisive action. Hope of a peaceful settlement of the Fiume question rests on the defeat of the militarists and nationalists in the coming election. Otherwise, unless Fiume is in the meantime given to Italy by the Peace Conference, it will be annexed by Italy without regard to the wishes of the powers.

American Forces Landed at Trau.—On September [illegible] the Secretary of the Navy announced that a force from the U. S. S. *Olympia* had landed and taken control of the port of Trau, on the Dalmatian coast, which had been occupied by Italians and which was evacuated without hostilities upon the landing of the American forces. It was stated that the action of Rear Admiral Philip Andrews, in ordering this move, had been authorized by the Supreme Council.

On September 29 two resolutions were introduced in the Senate and referred to committees, one condemning the action of the Supreme Council and the other merely calling upon the State Department for information. It was unofficially pointed out that the Dalmatian coast was enemy territory surrendered by Austria, not yet disposed of by the Peace Conference, and pending its decisions still under the trusteeship of the Allies. Until a settlement was reached, United States naval forces were assigned the duty of maintaining order on a part of the coast, and resisted the seizure of Trau as in violation of the terms of the temporary arrangement.

BELGIUM AND HOLLAND

Dispute Over Limburg and Control of Scheldt.—On September 21 press despatches stated that a diplomatic rupture between Holland and Belgium threatened as a result of Belgium's insistent demand that the frontier be altered so as to give her control of a small strip of the Dutch province of Limburg lying between Belgium and Germany, and also of Dutch territory south of the Scheldt. Domination of the southern bank of the Scheldt would secure Belgium against a Dutch blockade of the river mouth in time of war and against trade aggression in time of peace.

BULGARIA

PEACE TERMS TO BULGARIA.—The treaty of peace between the Allied and Associated Powers and Bulgaria was presented to the Bulgarian mission at the French Foreign Office, Paris, on September 19, the American representative in Paris, Assistant Secretary of State Frank L. Polk, taking part in the proceedings.

The terms of the treaty are officially summarized as follows: Bulgaria cedes Western Thrace (her booty after the Balkan wars) to the Allied and Associated Powers, with the understanding that she will accept whatever disposition of this territory the powers ultimately decide upon. Bulgaria also accedes to four slight rectifications of the Serbian frontier. It is understood that Bulgaria will be guaranteed an economic outlet to the Ægean, and that the question of her securing territory in the Dobrudja of Bulgarian population will be taken up later. The army must be reduced to 20,000 within three months, and about $500,000 must be paid by way of reparation.

It will be seen that while the question of Bulgaria's Ægean outlet, upon which President Wilson was inclined to insist, remains unsolved, Bulgaria suffers less severely in the peace settlement than her Teutonic allies.

TURKEY

NEW MINISTRY LESS AMENABLE TO ALLIES.—The Turkish Cabinet formed under Damad Ferid Pasha to make peace with the Allies was forced to resign on October 5 and was succeeded by a new Ministry under General Ali Riza Pasha. The change is said to have been brought about by General Mustapha Kemal, a Nationalist and "Young Turk" leader, who had established a rival government at Erzerum and occupied the railroad center of Konieh in Asia Minor. By the shift of ministry it is possible the government may come to terms with this faction. Turkey, it is thought, sees in the unsettled policy of the Western Powers an opportunity to alter to her advantage the severe terms which have been proposed for her at Paris.

RUSSIA

ADVANCE OF ANTI-BOLSHEVIK FORCES.—Despatches of October 6 reported that Polish troops, after two days' hard fighting, had captured Dvinsk, on the old Russo-Polish frontier.

General Denikin's forces, which already controlled great areas of southern Russia, were on the same date within 30 miles of the city of Orel, about 200 miles south of Moscow. Kolchak's forces, during their September offensive, advanced their front an average distance of 75 miles.

Simultaneously with this renewal of the offensive by Kolchak, and in spite of the withdrawal of Allied forces from northern Russia, the anti-Red troops in the Archangel district undertook offensive operations toward Petrograd.

In the meantime the Red government at Moscow was reported to have sent a wireless message renewing its offer to make peace on the same terms as those offered in the notorious Bullitt Report.

GERMANY INVITED TO JOIN BLOCKADE.—London, October 16 (Associated Press).—The text of the note of the Supreme Council inviting Germany to participate in the blockade of Russia, as published by the *Berlin Tageblatt* and reprinted by *The Daily Herald*, shows that Sweden, Norway, Denmark, Holland, Finland, Spain, Switzerland, Mexico, Chile, Argentina, Colombia, and Venezuela also have been invited to initiate measures to prevent their nationals from engaging in any trade with Bolshevist Russia. The measures are thus enumerated:

First.—Refusal of permission to sail to every ship bound for a Russian Bolshevist port and the closing of all ports to ships from Bolshevist ports.

Second.—Similar regulations to be adopted with regard to all goods destined for Russia by any other route.

Third.—Passports will be refused to all persons to or from Bolshevist Russia. Isolated exceptions may be made by agreement of the allied and associated powers.

Fourth.—Measures will be taken to hinder the banks from granting credit to commercial undertakings in Bolshevist Russia.

Fifth.—Every government will refuse its nationals any facilities of intercourse with Bolshevist Russia, whether by post or wireless telegraphy..

Marshal Foch added the following instruction:

"Inform the German Government that the British and French men-of-war in the Gulf of Finland will continue to blockade Bolshevist ports and detain from the moment they come in sight ships bound for Bolshevist ports."

The preamble to the note declares that the open enmity of the Bolsheviki is directed against all governments and that programs of international evolution, circulated by them, constitute a grave danger to the national security of all the powers. Every increase in the capacity of the Bolsheviki for resistance increases this danger, and it would be desirable that all nations wishing peace and the re-establishment of social order should unite together to resist Bolshevist Government.

For this reason, it is further declared, the allied and associated governments, after raising the blockade of Germany, have refused permission to their subjects to resume commercial relations with Bolshevist Russia.

The German Government is requested to take measures in conformity with those enumerated.—*N. Y. Times*, 17/10.

FAR EAST

UNITED STATES PROTESTS AGAINGST CONDUCT OF JAPANESE IN SIBERIA.—Tokio, October 9.—Orders have been issued by General Oi, commanding the Japanese forces in Eastern Siberia, directing his men to cooperate effectively with American authorities in the operation of the Trans-Siberian Railroad.

This is a result of strong representations made by the United States to the Japanese Government, claiming that in sections guarded by Japanese troops the lives and property of Americans have not been adequately protected. In the event that cooperation by the Japanese troops could not be secured, it is said, the note hinted American forces would be withdrawn from Siberia, and the reason for the step would be made public at Washington.

Reports state the American note was very frank in discussing the situation in Siberia and to have expressed the fear, by inference, that the policy of Japan there might be open to criticism as being opposed to the "new idea of international co-operation." It is understood a copy of the note of the Washington government, which was delivered in September, has been forwarded to Great Britain and France, and probably Italy and China.

Japanese officials seem inclined to minimize the gravity of the situation, and declare they have not been supporting General Semenoff, anti-Bolshevist leader, whose activities have occasioned concern in Allied circles. They are said to express belief that the question is open to early and amicable adjustment.—*N. Y. Times*, 10/10.

REVIEW OF BOOKS
ON
SUBJECTS OF PROFESSIONAL INTEREST

"Radio Instruments and Measurements." (Circular No. 74, Bureau of Standards.) Printed by the Wireless Press, New York, N. Y.

A compilation of radio information, especially as to measurements, intended for use of advanced students and radio engineers.

In its previous editions it has been found of the greatest value as a reference work in the radio course at the Naval Academy and in the compilation of a radio text-book for midshipmen.

While the book devotes 36 pages to the fundamentals of Electromagnetism and the Principles of Alternating Currents and leads up logically to Measurements, with unusually full mathematical theory, it is not, nor is it intended to be, a book suitable for use as a text-book.

Part I covers the Theoretical Basis of Radio Measurements. The Fundamentals of Electromagnetism. The Principles of Alternating Currents. Radio Circuits. Damping.

Part II. Instruments and Methods of Radio Measurements. Wave Meters. Coils. Current Measurements. Resistance Measurement. Sources of High-frequency Current.

Part III. Formulas and Data. Calculation of Capacity. Calculation of Inductance. Design of Induction Coils. High-frequency Resistance. Miscellaneous Formulas and Data.

B. C. A.

"New Words Self Defined." By C. Alphonso Smith, Head of the Department of English, U. S. Naval Academy. Price $1.25. (Doubleday, Page & Co.)

This attractive little volume does something new in the way of word definition. Instead of offering a synonym of the word or a definition of it in the style of a dictionary, Dr. Smith quotes one or more passages from newspapers, magazines, and books, in which the expression is used in such a way as to leave no doubt as to its meaning and the peculiar twist of its usage. The words simply define themselves. This is the most illuminating method of getting at the meaning provided the passage quoted is clear and comprehensive, but it must have been no easy task to hit on a satisfactory quotation for every instance.

Not all the words are new. "Gadget," "limey," "First Luff," and "padre," for example, are old in naval tradition. And "doughboy," as a footnote explains, goes back as a word to as early as 1685, and its application to the American soldier to our Civil War. Nor can "Amerind" be classed with the atrocities of the late war, because it was manufactured by a convention

of ethnologists several years ago as the scientific name for our red man. But most of these older words gained a far wider currency than ever before through the popular literature of the recent world conflict.

The great bulk of the words in this book, however, are new—the coinage of the soldiers and sailors, French as well as English and American. Every newspaper and magazine article bristled with them after 1914. Probably not one-tenth of them will survive 10 years hence because they are slang and slang dies easily. But they are more interesting than ordinary slang because they reflect the humor of the trench, the airplane, and the forecastle during the greatest war the world has known. They are a part of the human interest in the story of that war and therefore worth preserving.

Many also reveal interesting derivations. The famous "scrap of paper" phrase, for instance, quoted so often to the confusion of Herr von Hollweg, proves to have been in itself a quotation from Bismarck: "Treaties are scraps of paper. All depends on the manner of turning them to account."

To a future reader of the literature of the war, Dr. Smith's book will be invaluable; and even the reader of to-day, who followed every stage of the war, will find a host of words clarified for him which he has hitherto understood, if at all, only imperfectly.

W. O. S.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

S. A. TAFFINDER,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problems of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problems of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

1898

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut. Commander Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903

Gunnery in Our Navy. The Causes of Its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure Its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905

American Naval Policy. Prize, Essay 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear Admiral Stephen B. Luce, U. S. N.

1906

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut. Commander A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906 By Pay Inspector J. A. Mudd. U. S. N.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A Few Thoughts on Our Next Step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut. Commander Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENCE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut. Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotton, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut. Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut. Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut. Commander Dudley W. Knox, U. S. N.

1914

The Great Lesson from Nelson for To-day. Prize Essay, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

NAVAL POLICY AS IT RELATES TO THE SHORE ESTABLISHMENT AND THE MAINTENANCE OF THE FLEET. Honorable Mention, 1914. By Captain John Hood, U. S. N.

OLD PRINCIPLES AND MODERN APPLICATIONS. Honorable Mention, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

MILITARY PREPAREDNESS. Honorable Mention, 1914. By Naval Constructor Richard D. Gatewood, U. S. N.

1915

The Rôle of Doctrine in Naval Warfare. Prize Essay, 1915. By Lieut. Commander Dudley W. Knox, U. S. N.

AN AIR FLEET: OUR PRESSING NAVAL WANT. First Honorable Mention, 1915. By Lieut. Commander Thomas Drayton Parker, U. S. N.

TACTICS. Second Honorable Mention, 1915. By Ensign H. H. Frost, U. S. N.

DEFENCE AGAINST SURPRISE TORPEDO ATTACK. Third Honorable Mention, 1915. By Ensign R. T. Merrill, 2d, U. S. N.

1916

The Moral Factor in War. Prize Essay, 1916. By Lieutenant (J. G.) H. H. Frost, U. S. N.

NAVAL PERSONNEL. First Honorable Mention, 1916. By Lieut. Commander J. K. Taussig, U. S. N.

EDUCATION AT THE U S. NAVAL ACADEMY. Second Honorable Mention, 1916. By Lieutenant Ridgely Hunt, U. S. N.

SOME UNDERLYING PRINCIPLES OF MORALE. Third Honorable Mention, 1916. By Commander Dudley W. Knox, U. S. N.

LARGE *vs.* A GREATER NUMBER OF SMALLER BATTLESHIPS. Lippincott Prize Essay. By Lieut. Commander Thomas Lee Johnson, U. S. N.

1917

Commerce Destroying in War. Prize Essay, 1917. By Commander Lyman A. Cotten, U. S. Navy.

THE PEOPLE'S RÔLE IN WAR. First Honorable Mention, 1917. By Lieutenant H. H. Frost, U. S. Navy.

THE NATION'S GREATEST NEED. Second Honorable Mention, 1917. By Colonel Dion Williams, U. S. Marine Corps.

1918

Letters on Naval Tactics. Prize Essay, 1918. By Lieutenant H. H. Frost, U. S. N.

THE PREPAREDNESS OF THE FUTURE. First Honorable mention, 1918. By Commander H. O. Rittenhouse, U. S. N. Retired.

NAVAL STRATEGY. Second Honorable Mention, 1918. By Rear Admiral Bradley A. Fiske, U. S. N.

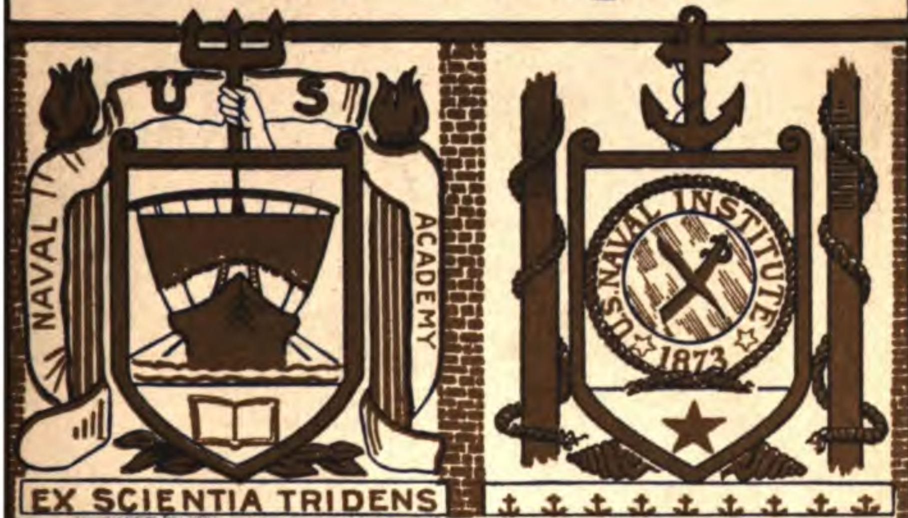
1919

MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.

SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

VOL. 45 DECEMBER 1919 No. 202

United States Naval Institute Proceedings



The writers only are responsible for the contents of their respective articles

CONTENTS

Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 12 December, 1919 Whole No. 202

United States Naval Institute

Proceedings

PUBLISHED MONTHLY
EDITED BY S. A. TAFFINDER

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

CONTENTS

OFFICERS OF THE INSTITUTE

President

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

Vice-President

REAR ADMIRAL A. H. SCALES, U. S. NAVY

Secretary and Treasurer

COMMANDER S. A. TAFFINDER, U. S. NAVY

Board of Control

CAPTAIN W. T. CLUVERIUS, U. S. NAVY
CAPTAIN T. L. JOHNSON, U. S. NAVY
CAPTAIN E. J. KING, U. S. NAVY
CAPTAIN W. G. DU BOSE, CONSTRUCTION CORPS, U. S. NAVY
CAPTAIN AMON BRONSON, U. S. NAVY
COMMANDER B. C. ALLEN, U. S. NAVY
COMMANDER S. A. TAFFINDER, U. S. NAVY (*ex officio*)

PAST PRESIDENTS

OF THE

U. S. NAVAL INSTITUTE

ADMIRAL DAVID D. PORTER, U. S. NAVY, 1873
REAR ADMIRAL JOHN L. WORDEN, U. S. NAVY, 1874
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1875–JAN. 1878
COMMODORE FOXHALL A. PARKER, U. S. NAVY, JAN. 1878–JAN. 1879
REAR ADMIRAL JOHN RODGERS, U. S. NAVY, JAN. 1879–JAN. 1882
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1882–JAN. 1883
REAR ADMIRAL THORNTON A. JENKINS, U. S. NAVY, JAN. 1883–OCT. 1885
REAR ADMIRAL EDWARD SIMPSON, U. S. NAVY, OCT. 1885–OCT. 1887
REAR ADMIRAL STEPHEN B. LUCE, U. S. NAVY, OCT. 1887–OCT. 1898
REAR ADMIRAL WM. T. SAMPSON, U. S. NAVY, OCT. 1898–OCT. 1902
REAR ADMIRAL H. C. TAYLOR, U. S. NAVY, OCT. 1902–OCT. 1904
REAR ADMIRAL C. F. GOODRICH, U. S. NAVY, OCT. 1904–OCT. 1909
REAR ADMIRAL RICHARD WAINWRIGHT, U. S. NAVY, OCT. 1909–OCT. 1911

FLAGSHIP OF THE PACIFIC FLEET, THE U. S. S. "NEW MEXICO," IN THE MIRAFLORES LOCKS, READY TO PASS INTO THE PACIFIC OCEAN.

A nation exists many years in peace for each year of actual warfare, yet naval development is constantly progressive. Nations sufficiently powerful to require navies cannot afford to possess equipment or to employ methods which are known to be inferior to those of the navies of other nations. Excellence of design and construction of equipment, if arrived at by efficient processes and if based on correct principles, will tend toward economy in cost as well as effectiveness in use if operated by a well-instructed and well-disciplined personnel.

It should be obvious without further discussion that a navy must have exceptionally able leaders and designers, and that the difficulties which beset the paths of these men may well be greatest during times of peace. Then the task of preparing the navy for war must be undertaken without the advantage of the experience of constant warfare. The advances of science and invention tend to render obscure the proper applications of the lessons of past wars, and this condition increases from year to year, so that, after a long period of peace, a navy can only be prepared for war if it has progressed under the guidance of leaders of exceptional originality, mentality, analytic ability, and judgment.

But the load does not fall entirely on the leaders. With the extended use of complicated electrical and mechanical equipment, tending more and more toward automatic control, the demands on the intelligence and training of the operative personnel increase enormously. The desire may exist to avoid the use of such devices, but the impossibility of permitting their use by other navies, without having something else to offset the advantages which they undeniably confer, forces their adoption. Consider, for example, the submarine, the torpedo, director firing, " follow the pointer " systems. To train the operative personnel in the use and upkeep of these devices there must be a great body of sea-going line officers possessing in well-balanced quantities the essentials of intelligence, energy, good judgment, and loyalty to the ideals of the naval profession. The quality of courage can almost be assumed for men of this type, together with determination and perseverance necessary to make them fighters.

In addition to the leaders proper and the sea-going line officers, there must also exist an appreciable number of junior officers of the line who must exercise administrative, executive, and technical

UNITED STATES NAVAL INSTITUTE
PROCEEDINGS

Vol. 45, No. 12 DECEMBER, 1919 Whole No. 202

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PROMOTION AND NATURAL SELECTION

By Lieut. Commander F. S. Craven, U. S. Navy

I

It is necessary to have a clear understanding of the duties and functions of the commissioned personnel of the navy in order to form an intelligent opinion on promotion. These functions have been undergoing steady alteration in keeping with the rapid development of mechanical devices in all branches of the naval service. It is proposed to discuss generally the functions of the commissioned personnel which result from modern conditions, in order to establish the basis for the system of promotion and selection advocated in this article.

The United States Navy, built upon the principle that the best defence lies in a vigorous offensive, is, therefore, an offensive military organization. The personnel for such an organization should primarily be fighters, but the commissioned personnel necessarily have other duties as well. A most important duty—an *essential* duty—is to perfect the organization and the matériel so that the navy will be prepared to fight successfully when war comes.

A navy, much more than an army, is an organization of slow development. Years are required to design and build a battleship, and months are required to train a recruit to be of material value as a member of its crew. A vital mistake in design, once incorporated into the fabric of a ship, can seldom be corrected, and, because of the cost and time involved, the defective ship cannot be discarded, but must be employed as a unit of the fleet.

Copyright by International Film Service.

ANT. THE U. S. S. "NEW MEXICO," IN THE MIRAFLORES LOCKS, READY TO PASS INTO THE PACIFIC OCEAN.

difficult and of doubtful correctness, whereas prior to that stage there should be but a small proportion of error. It is not proposed, therefore, to attempt selection out in the middle grades, but rather to permit this portion of the personnel, having survived the pruning, to progress smoothly along the path of promotion by seniority, with ample opportunity for the undisturbed development and *demonstration* of the qualities of leadership.

There may now be laid down a concrete plan for promotion and selection in the line of the navy, based on the application of what really are the laws of nature:

Selection Out:

1. By physical and mental examinations for entrance to the Naval Academy, essentially as at present.

2. By psychological, physical, and mental tests applied during the course at the Naval Academy.

3. By modified forms of similar tests applied to the young officers in the grades of ensign, lieutenant, junior grade, and lieutenant.

4. By automatic retirement of commanders and captains who fail to achieve Selection Up, with certain reservations explained later.

Special Selection:

1. In the grades of lieutenant and lieutenant, junior grade, for technical specialties, including ordnance design, engineering design, electrical design, naval construction, and shop management.

2. In the grades of lieutenant commander and lieutenant for professional specialties, including gunnery, fire control, torpedo control, communications, tactics, and the like.

3. From captains and flag officers for high administrative positions in the department and for command afloat, essentially as at present.

Selection Up:

1. From commander to captain.

2. From captain to flag rank.

III

The processes for Selection Out in the lower grades and for special selection for training are practically identical, because in

OFFICERS OF THE INSTITUTE

President

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

Vice-President

REAR ADMIRAL A. H. SCALES, U. S. NAVY

Secretary and Treasurer

COMMANDER S. A. TAFFINDER, U. S. NAVY

Board of Control

CAPTAIN W. T. CLUVERIUS, U. S. NAVY
CAPTAIN T. L. JOHNSON, U. S. NAVY
CAPTAIN E. J. KING, U. S. NAVY
CAPTAIN W. G. DU BOSE, CONSTRUCTION CORPS, U. S. NAVY
CAPTAIN AMON BRONSON, U. S. NAVY
COMMANDER B. C. ALLEN, U. S. NAVY
COMMANDER S. A. TAFFINDER, U. S. NAVY (*ex officio*)

PAST PRESIDENTS

OF THE

U. S. NAVAL INSTITUTE

ADMIRAL DAVID D. PORTER, U. S. NAVY, 1873

REAR ADMIRAL JOHN L. WORDEN, U. S. NAVY, 1874

REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1875–JAN. 1878

COMMODORE FOXHALL A. PARKER, U. S. NAVY, JAN. 1878–JAN. 1879

REAR ADMIRAL JOHN RODGERS, U. S. NAVY, JAN. 1879–JAN. 1882

REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1882–JAN. 1883

REAR ADMIRAL THORNTON A. JENKINS, U. S. NAVY, JAN. 1883–OCT. 1885

REAR ADMIRAL EDWARD SIMPSON, U. S. NAVY, OCT. 1885–OCT. 1887

REAR ADMIRAL STEPHEN B. LUCE, U. S. NAVY, OCT. 1887–OCT. 1898

REAR ADMIRAL WM. T. SAMPSON, U. S. NAVY, OCT. 1898–OCT. 1902

REAR ADMIRAL H. C. TAYLOR, U. S. NAVY, OCT. 1902–OCT. 1904

REAR ADMIRAL C. F. GOODRICH, U. S. NAVY, OCT. 1904–OCT. 1909

REAR ADMIRAL RICHARD WAINWRIGHT, U. S. NAVY, OCT. 1909–OCT. 1911

5. Arrange the names of all eligibles according to values of average percentages. In this list no evidence of number of votes received will appear, and the service opinion will therefore be indicated in a *qualitative form.*

The preceding description may sound complicated, but its actual application is very simple. An example is given below of a list of eleven names with three considered unfit for selection:

Serial No.	Name	Divisor	Percentage
19	Wilson	19	100
18	Green	"	95
17	Smith	"	90
16	Cook	"	84
15	Brown	"	79
14	Evans	"	74
13	Black	"	68
12 (N + 1)	Clark	"	63
3	Jones	"	16
2	Stevens	"	11
1	White	"	5

There remains to suggest that the consideration of the Selection Board proper should be restricted to the fitness reports of the eligible in his present grade, and to his relative standing in service opinion, as determined above. It must be remembered that faults which caused unfavorable reports in the early grades will have been put to good use in building a character which will obtain for the individual a high place in service opinion when he is available for selection for leadership. Sea service should not be considered an essential qualification for selection, because in modern times the necessity for specialization in administrative work is as great as for specialization in operations at sea, and distinct types of men are required for each. Nor should this board consider physical records, which can obviously be most intelligently interpreted by medical officers, guided by a proper statement of policy. Physical matters should obviously be investigated prior to action by the Selection Board, and an officer found physically disqualified should, of course, be retired. He may then be employed, if he so desires, in the manner previously suggested for officers selected out. If this retirement take place prior to the submission of the lists, then there will be no doubt in the minds of the service that the reason was physical disability.


NORWAY
AREA C
AREA A
AREA B
SHETLAND ISLANDS
ORKNEYS
SCOTLAND
NORTH
SEA
MINE
FIELD
DENMARK
IRELAND
ENGLAND
BALTIMORE MINE FIELD
SKAGERRACK

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE YANKEE MINING SQUADRON [1]

OR

LAYING THE NORTH SEA MINE BARRAGE

By CAPTAIN REGINALD R. BELKNAP, U. S. Navy
The Squadron Commander

PREFACE

In writing of the "biggest 'mine planting stunt' in the world's history"—to quote a Christmas greeting from Rear Admiral Clinton-Baker, head of the British minelaying force—I have endeavored to make an account that would be readable enough for general interest, largely for the reason that, compared to other operations, our undertaking received scant mention at the time. Its very nature required preparation in quiet and precluded discussion of its progress. Unnecessary technical detail has therefore been suppressed, although much could be written that would be welcomed by those versed in it.

The whole account is based on data obtained at first hand. The description of assembling the squadron for a mining excursion fits the third excursion rather than the first, but the difference is a minor one, affecting only the numbers present—six ships on the first excursion, ten on the third. All the rest is correct, in substance and details.

Besides influencing an early armistice, this great minelaying operation marks an epoch in the use of submarine mines in warfare. It was an event in military history, as well as a prominent operation, and the credit for it belongs not alone to the officers and men who were actually present but also to those of the old mine force, to whose services in developing, in our navy, the art of handling and laying mines in large numbers, the success of the great operation was so largely due.

Details of the mechanical development of the new mine itself have not been gone into, for obvious reasons. Justice to that part

[1] This article will appear in three installments.

could be done only by those who were directly concerned in it, but I am glad of the opportunity to express appreciation of the valuable service which was rendered to our cause in the war by Commander S. P. Fullinwider, U. S. N., in seizing upon and developing the long-sought means for such an undertaking, and by Lieut. Commander T. S. Wilkinson, U. S. N., and the officers and designing engineers in the Bureau of Ordnance and at the Naval Torpedo Station, Newport, R. I., by their skill and ingenuity in designing mechanical features, when normal experimenting was impossible.

As for the ships—the personal study which Captain J. D. Beuret (C. C.), U. S. N., made of the mine elevator problem was the foundation of its brilliant success, and the fact that, in the whole period of service, few alterations or improvements in the minelayers were found desirable, although suggestions were called for, is the best tribute to those who planned and carried out their conversion.

Only very inadequate expression can be given here to my appreciation of the services of my staff, in particular Captain H. V. Butler, U. S. N., whose excellent conduct of the flagship, supported by the indefatigable care of his navigator, Lieut. Commander J. C. Cunningham, U. S. N., made it possible to approach and navigate close to unmarked minefields in the open sea. And I was fortunate to have one so thoroughly loyal and capable as Commander B. L. Canaga, without whose unremitting attentiveness, and tactful management of countless details under difficulties, our performance would have been far less creditable.

Inseparable from our recollections will always be the excellent and friendly official and personal relations with the destroyer escort, especially when H. M. S. *Vampire* led. Captain H. R. Godfrey, C. B., D. S. O., writes, "It was the determination of every officer and man in the 14th Flotilla, who had the honor of being entrusted with the screening of the U. S. Minelaying Force, that no preventable attack by enemy submarine or surface vessel should inflict damage on any ship of the Force." It is but speaking for all of us to say, that is what we felt, from the first moment of that grey morning's meeting on the day of arrival.

NEWPORT, 15 June, 1919.

THE YANKEE MINING SQUADRON

CHAPTER ONE

THE MINE FORCE READY

The national anthem at morning colors woke me, and I arose and looked out. What a glorious sight! Green slopes in all freshness, radiant with broom and yellow gorse, the rocky shore mirrored in the Firth, which stretched, smooth and cool, wide away to the east and south, and in the distance snow-capped Ben Wyvis. Lying off the entrance to Munlochy Bay, we had a view along its sloping shores into the interior of Black Isle, of noted fertility. Farther out were Avoch, a whitewashed fishing village, and the ancient town of Fortrose, with its ruined 12th century cathedral. Across the Firth lay Culloden House, where Bonnie Prince Charlie slept before the battle. Substantial, but softened in outline by the morning haze, the Royal Burgh of Inverness covered the banks and heights along the Ness River, gleaming in the bright sunshine. And how peaceful everywhere! *Canandaigua* and *Sonoma* lay near by, the *Canonicus* farther out—but no movement, no signal, no beat of the engines, no throbbing pumps. All seemed resting from those last four days of our passage overseas, which had all but done away with sleep. My responsibility for the safe conduct of the squadron had ended at 1 a. m., when it dispersed at the buoy, whence the routes to our bases at Inverness and Invergordon diverged. The captains taking the ships to their berths singly, Captain Butler was up until 5 o'clock, needing daylight to take the *San Francisco* all the way in. Turned in at last, his servant and orderly at 8 o'clock were 45 minutes waking him.

The Senior British Naval officer, Captain H. F. J. Rowley, R. N., came on board early, to give us welcome, and then we went to our own chief, Rear Admiral Joseph Strauss, U. S. N., commander of the Mine Force, whose headquarters were here at Inverness, U. S. Naval Base 18. After taking a look over the base itself, Captain Murfin's work and province, we stayed to lunch at Kingsmills, a handsome place amid beautiful surround-

supplied from the Royal Naval Dockyard and two depots, under Rear Admiral E. R. Pears, R. N., and Captain Tancred at Invergordon, and Captain Rowley at Inverness, who were always cordially responsive to our requests.

The motto for all American naval forces abroad, however, was to be self-supporting, and thanks to our provident first supply and to regular replenishment by the mine carriers, we had to draw on the British stocks for very little. After a month, the repair ship *Black Hawk* arrived. She took no part in minelaying, being always moored off Inverness, separate from the Mine Squadron and flying Rear Admiral Strauss' flag, but her equipment of machine tools and repair material made the Mine Force normally independent in regard to upkeep. Except for docking, we asked very little of the British in the way of repairs.

Upon one occasion, the soluble salt washers for the principal safety device of the mines nearly ran out, the local atmospheric conditions having caused many more to be used than estimated. No washers of the right size and kind were obtainable anywhere inside three weeks, and thus a shortage of these atoms—the size of a peppermint " Life Saver "—threatened to hold up the laying of 5000 mines. The *Black Hawk* had a steam press, however, and could make a die—and by the time they were needed, washers in plenty were ready—incidentally of better quality than before.

While the ships were unloading the mines they had brought, for overhaul on shore, and were coaling and otherwise preparing for minelaying, the larger preliminaries were taken up at a conference of Rear Admiral Strauss and myself with Admiral Sir David Beatty, Commander-in-Chief of H. B. M. Grand Fleet. Vice Admiral Brock, his Chief of Staff, Rear Admiral Clinton-Baker, the British Rear Admiral of Mines, Captain Lockhart-Leith, the head of his Staff, and Captain R. A. Pound, of the Admiralty, attended this conference, which was held on board the flagship *Queen Elizabeth,* at Rosyth, Thursday, 30 May, 1918.

First came the subject of tactics, and I explained my plan, to lay the mines with the squadron steaming in line abreast, ships 500 yards apart, making a trace on the chart like a music score. Three vessels (later five) would be laying mines simultaneously. When a ship had emptied herself of mines, her neighbor, ready and waiting while steaming alongside, would begin. At the end of the

minefield, some temporary small buoys would be planted, by which to pick the field up later, to continue it. This plan was accepted without comment.

The area to be mined having been publicly notified two months before, the enemy might have placed some mines there, on the random chance of damaging our force. The only arrangement practicable to meet such a contingency was for some of the destroyer escort to explore for mines ahead of the minelaying formation as it proceeded. Only those ships would be fully protected that might be following directly in the wake of the searching destroyers, the main purpose being to discover the existence of an enemy minefield in time for the squadron to maneuver aside.

A clear understanding was reached at the conference of the relation of the mine squadron and its escort to the supporting force. The mine squadron being lightly armed and of moderate speed, it would have been at great disadvantage against even a numerically weaker force of light cruisers, with their superior batteries and speed. Hence the need of the support, which would consist of a battleship or battle cruiser squadron, or both, and of light cruisers, according to the estimated risk of attack at the time. If attack threatened, the mine squadron and its destroyer escort would seek safety in the direction ordered by the Support Commander; otherwise they would proceed on their mission and return to base afterwards, according to the program for that occasion. The destroyer escort would be of strength sufficient to ward off any probable attack by submarines or by surface vessels that might elude the supporting force and the regular patrols.

The location of the first minefield was decided upon; then further details were settled with Vice Admiral Brock and Rear Admiral Clinton-Baker, for the first mining excursion, which was to be done by the American and British squadrons at the same time. Preparatory notice was to be given by the Commander Mine Force to the Admiral of the Grand Fleet at least four days before the time the mine squadron was expected to be loaded and ready for an excursion. Upon a second, definite notice, not less than 48 hours in advance, when it was certain that the squadron would be ready, a combined operation order would be issued by the Admiral, naming all the forces concerned and containing the instructions and intelligence necessary for all.

After lunching on board with Admiral Beatty, Rear Admiral Strauss and I took our leave. We had a look at Holyrood Palace and a walk through Canongate Street that afternoon, returning to Inverness next day. Not enough material had yet been accumulated to assemble mines to fill all seven minelayers present, but 3400 would be ready in a few days, sufficient to lay a field 47 miles long, consisting of one row of mines at each of the three levels prescribed. A mine embarking schedule was made out accordingly, to include *San Francisco, Baltimore, Roanoke, Canandaigua, Canonicus,* and *Housatonic,* for a start on June 7.

CHAPTER TWO

THE NEED AND THE MEANS

A barrier of high explosive across the North Sea—10,000 tons of TNT, 150 shiploads of it, spread over an area 230 miles long by 25 miles wide and reaching from near the surface to 240 feet below—70,000 anchored mines each containing 300 pounds of explosive, sensitive to a touch, barring the passage of German submarines between the Orkneys and Norway—this was the final five months' contribution of the American and British mining forces towards bringing the war to a close.

To stop the enemy submarines near their bases, before they could scatter on the trade routes, would obviously defeat their campaign more surely than merely hunting them at large. That was the purpose of the Northern Mine Barrage, which, with the barrage at Dover, made it not impossible but extremely hazardous to enter or leave the North Sea. That many a submarine came to grief in attempting these barriers is now a certainty, and the establishment of the Northern Barrage, which many had thought impossible, insured the early finish of the submarine campaign.

The resumption of ruthless submarine warfare became a serious threat to the cause of the Allies, and at the time of our entry into the war their situation was critical—how much more critical than the world was allowed to know at the time, Admiral Sims has disclosed in his "The Victory at Sea." The relief brought about through the convoy system, in which our destroyers, the navy's first participants, had a large share, was immediate and important. But the submarine menace was far from ended and—according to the best information—would soon be greatly augmented, while the increasing number of transports would offer the enemy more opportunities, with the added horror of troopship sinkings in prospect.

Of further measures, the most effective would be such a blockade as would keep the submarines in or from their bases. The British had already mined a large area north and west from Heligoland, but this obstruction was not insurmountable, for the

Germans from nearby could always clear a passage through when wanted. In any case, until the Skagerrack passage were closed, the submarines might use that route without hindrance. Two weighty reasons kept the Skagerrack open—unwillingness to violate neutral waters, and the ease with which German forces could raid any barrier near their bases. It may be recalled with what sudden damage a small German cruiser detachment raided a convoy just outside the Skagerrack, in October, 1917.

To be effective, therefore, any barrier must be beyond easy reach of a raiding force and cover the Skagerrack, and must also be far enough to the northward of the British bases not to hamper the battle fleet's engaging with the enemy. Hence, the anti-submarine barriers should be, one near Dover Strait, the other across the North Sea, from Scotland to Norway.

The closing of Dover Strait, undertaken by the British Navy alone, needs no further mention here. Although the strong tidal currents there, frequent rough seas, and hard, smooth bottom were unfavorable for minefields, other means—such as a line of guard vessels moored not far apart and equipped with powerful searchlights, together with numerous active patrollers—were employed with a considerable degree of success.

The Northern Barrage would be too long a front, and much of it too far from base, for effective patrol without a great number of vessels. A wide, thickly sown minefield, however, would watch night and day in all weathers without relief, and would be even more effective against passage submerged than against passage on the surface, because of the less wear and disturbance of the mines by wave action, deep down under water.

Currents were not strong in the northern location, but the bottom lay as deep as 900 feet, whereas 300 feet had heretofore been the deepest water ever mined. Merely to provide the mines meant a large undertaking, besides involving an enormous quantity of the same high explosive which was likewise in heavy demand for shells and bombs. Supposing the mines ready, the planting of so many would be a long and dangerous operation, employing all the Allies' existing minelayers indefinitely. And neither the British nor ourselves yet had a mine that was quite satisfactory for the prospective requirements.

Our Naval Bureau of Ordnance, however, was intent on finding the means for such a barrier, so that when, in May, 1917, among the many contrivances offered for winning the war, Mr. Ralph E. Browne, an electrical engineer of Salem, Massachusetts, presented his submarine gun for consideration, Commander S. P. Fullinwider, U. S. N., in charge of the Bureau's mining affairs, saw that, although the invention was not suitable for naval purposes in the form offered, a new electrical device which it contained, if applied to the firing mechanism of a submarine mine, would result in just what we were looking for—a mine at once sensitive and far reaching. Mr. Browne collaborated with the Bureau of Ordnance in developing the new mine-firing device. By July, 1917, all doubt as to its practicability had been dispelled and the Bureau of Ordnance was able to give assurance that, in urging the closing of the German bases, our navy might offer the means.

Extravagant claims were common in the field of mining inventions, and three years of war lessons in the perversity of mines made the British naturally skeptical of this American find. An experienced officer in mining was sent over to see, Lieutenant R. H. DeSalis, R. N., who had received the D. S. O. for some minelaying on the Belgian coast. As the new device was put through its paces before him, the chill thawed out and in two hours he had become almost an enthusiast. Upon his report the British Admiralty took up the plan with active interest.

Upon returning from London in mid-October, 1917, Admiral Mayo, of our Atlantic Fleet, brought back the outline of a proposed minelaying operation. The paper was quite informal—unsigned, undated, bearing in pencil across the top, "Admiralty would be glad to learn whether Navy Department concur in the plans as shewn."

The field was to be 230 miles long—the distance from Washington to New York—divided into three parts, the middle section, of 135 miles, called Area A, allotted to us, because the reach of the new American mines was greater than ordinary—three of them covering the same extent as eight mines of other types. Thus numbers and effort were saved.

There would be three "systems," each consisting of one or more rows of mines just below the surface, dangerous to any craft, and other rows at intermediate and extreme depths, so that,

whether running on the surface or at ordinary submergence or as deep as 240 feet, a submarine had the odds against her. In the absence of patrol vessels to drive them down, submarines would naturally run on the surface, and so the rows of upper level mines were made more numerous than those at deeper levels. The stroke of a mine is sudden and powerful, and while a vessel on the surface may survive it, to a submerged submarine it is usually fatal. All classes of vessels shy at a minefield, and that the Germans shared this aversion was shown by captured papers, which made it clear that the submarines dreaded nothing so much as mines.

The scheme was unprecedented, and that its great magnitude would involve a mass of detail requiring very careful adjustment was evident on the most cursory examination. Some who heard of it regarded it as impossible, and foolish to attempt. As to the new mines, the very basis of the whole project—since a complete unit would not exist for several months, the statement of Rear Admiral Ralph Earle, Chief of the Naval Bureau of Ordnance, that the mines would be forthcoming in season, had to be based upon tests of the mine only by parts, with the assumption that all would function properly when assembled. Action upon that assurance would at once involve upward of forty million dollars, which made his stand a bold one, inviting unmeasured odium, should the mine after all fail. To await the mine's final proving, however, would have been fatal to any possibility of beginning the barrage before 1919.

The task of laying the barrier would be hazardous in itself, with constant danger of interruption by the enemy. A single minefield in the open sea, or widely separated ones, presented no extreme difficulties, but to lay a series of them so close together as to leave no considerable gaps between, made a problem for which no really practical solution was yet visible.

For four days the project was under consideration by the Naval General Board at Washington. Time pressed, the need was great, the new mine very promising. The attitude of our officers was favorable. My own expressed view, based on three years' experience in mining, was that, though much greater difficulties and magnitude would develop even than yet foreseen, the scheme was nevertheless feasible, was within our minelaying experience in principle, and, though it could hardly be more than half or a

quarter effective, it was well worth doing. The British Admiralty's approval and belief in the practicability of the scheme was implied in the original paper, but an explicit confirmation was asked and obtained by cable, on the basis of their three years' war experience and knowledge of North Sea conditions. And so the plan went to the Secretary of the Navy bearing the General Board's approval, as promising a sufficient degree of success to warrant undertaking it.

CHAPTER THREE

THE BASES IN SCOTLAND

The British Minelaying Squadron was to operate from Grangemouth, near Rosyth, on the Firth of Forth. As a mine assembling and operating base for the American Squadron, the British naval authorities decided on Inverness and Invergordon, in the Scottish Highlands, situated on Inverness Firth and Cromarty Firth, re-

MINE ASSEMBLY AND STORAGE SHEDS.
U. S. Naval Base 18, Inverness.

spectively, which empty into Moray Firth about eight miles apart. One base would have been enough and in some respects more convenient, but the limited transportation means across Scotland necessitated two. To require the slow mine carriers to navigate the difficult passages around the north of Scotland would prolong their exposure to submarines and cause more escort duty for destroyers, so it was decided to discharge their cargoes on the west side, at points which gave a short haul across Scotland—Fort William, at the western terminus of the Caledonian Canal, and Kyle of Loch Alsh, where one crosses to the Isle of Skye. The cargoes were transported by canal motor-barge and by the Highland Railway.

In order to issue mines to the ships ready in all respects for planting, the bases needed a large number of men for shop work, besides others for transportation, police, clerical work, messmen, and sanitation. The entire establishment on shore was under Captain O. G. Murfin, U. S. N., who had 20 American naval officers and 1000 enlisted men at each base, 3 officers and 60 men at each of the unloading points, Fort William (actually at Corpach village) and Kyle. Headquarters was at Inverness, because of its superior communications and more central location. Captain Murfin had sailed November 13, for England, to supervise the preparation of the bases. With him had gone Commander T. L. Johnson, then commanding the small minelayer *Dubuque*, who was to inform himself fully on the situation and return to Washington as soon as practicable with answers to a long list of questions—everything we could then think of as useful to know for intelligent coöperation in the preparations.

The large, substantial, stone buildings of two idle distilleries, Dalmore, three miles out from Invergordon, and Glen Albyn, at Muirtown, where the Caledonian Canal locks out to Inverness Firth—clean, dry, and well ventilated—gave excellent living accommodations for the men. The smaller buildings made suitable offices, but considerable additions were made for messing, cooking, and washing arrangements. A Y. M. C. A hut was established in each base, and at Inverness the little Muirtown Hotel was transformed into a small hospital. This, and similar provision at Dalmore, all under Captain E. J. Grow (M. C.), were for mild or emergency cases. The main dependence for hospital care was Strathpeffer—a " hydro " cure in peace time—20 miles from either base. There a U. S. Naval Base Hospital of 1000 beds had been established, under Captain E. S. Bogert, Medical Corps, with the Leland Stanford unit.

The buildings for mine assembly and storage were erected on adjacent vacant land, spur tracks being brought in from the main railway line, thus making good communication between the two bases, as well as with their receiving sources and shipping out points. Most of the machine tools and other shop and office equipment, as well as furnishings for the men's use, came from the United States.

Some dredging was done in Inverness Firth to admit our minelayers into Beauly Basin, near the canal entrance. The navigation

marks for entering the Firth were improved, because ordinarily vessels of our size seldom came in there, and then only by day. In addition, the whole length of the Caledonian Canal was lighted, for night navigation by the mine carrying lighters.

Labor was scarce in the Highlands and the weather that winter was severe. The work went slowly, delayed considerably beyond expectation. Captain Murfin had many discouragements, and disappointments in deliveries from the United States. In spite of the kindness of all about him, he must often have felt very far away from home; but afterwards, the frank admiration repeatedly expressed by all visitors to the bases must have repaid his six long months of effort. In the end, the bases were ready in time, and their capacity, and the rate of transportation as well, were twice the original estimate, the two bases together being capable of assembling 1000 mines a day ready for planting.

Sending over the base personnel began with small drafts in December, but as accommodations for the full number were not ready soon enough, and the demand to use all transportation for troops became pressing during the Germans' great drive in March, 1918, the base complements were not more than about two-thirds full when the mine squadron sailed from the United States coast in May. The greater part, 750, of the number then lacking had therefore to be brought over by the squadron. Though this retarded the proper organizing of the base personnel, it did not delay the minelaying.

CHAPTER FOUR

THE SUPPLY OF MINES

In the same past six months other preparations, too, had been pushing ahead, both at home and abroad. Providing the mines—

A MINE IN MID-AIR, BEING HOISTED IN.
The Plummet is at the Lower Left Corner.

the task of our Naval Bureau of Ordnance—would alone make a story of great interest. Considering how long it had taken to develop previous types of mines, to have made a success of an invention that was new since our entering the war was indeed

remarkable, the more so from inability to test a single mine complete before ordering 100,000.

Mines for the open sea in great numbers, moored "flying"—that is, by ships steaming at considerable speed—need anchors with automatic depth regulation. Such mechanism had undergone important changes during the war, and the new American mines

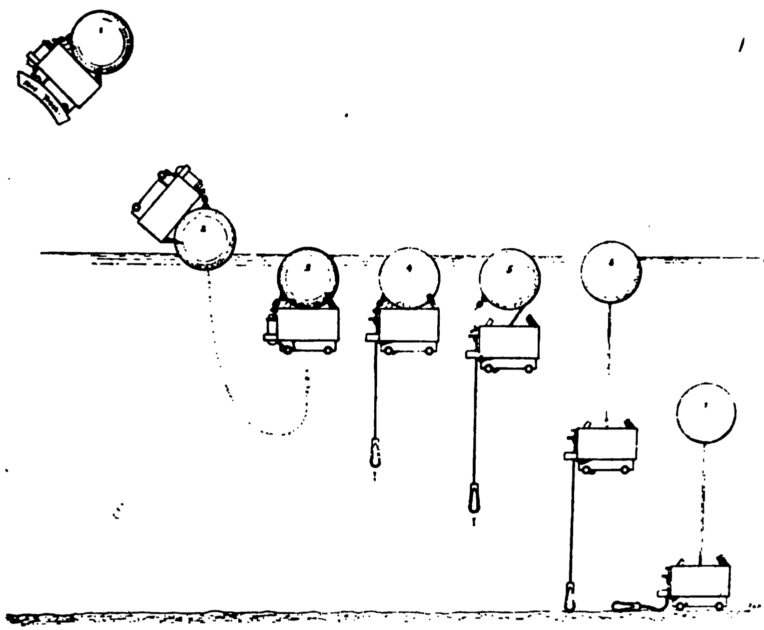
LAUNCHING A MINE THROUGH THE STERN PORT.
There is a Nine-Foot Drop, from Rails to Water.

needed all the improvements, to make them sure to plant at the intended level. They were to be much deeper than ever attempted before, and also in deeper water.

Three British officers of considerable mine experience assisted here, Lieut. Commander H. O. Mock, R. N. R., Lieutenant R. H. DeSalis, R. N., and Lieut. Commander Harold Isherwood, R. N. V. R. The last was an expert designer, and had an important part

in planning our new mine anchor, which was similar to a late model British mine anchor.

A submarine mine of to-day consists of a mine case, shaped like a ball or egg, about one yard in diameter, mounted on an anchor in the form of an iron box about 30 inches square, connected by a wire rope mooring cable, about ⅜ inch in diameter. The mine case contains the charge of high explosive—300 pounds of TNT in our mines—and the firing mechanism. The combination stands about 5 feet high and weighs 1400 pounds. Four



THE SEQUENCE OF OPERATIONS AFTER A MINE IS LAUNCHED.

small car wheels on the anchor run on steel tracks, allowing the mines to be easily moved along the decks to the launching point.

When the mine dives overboard, the mine and anchor come to the surface and float for a time, still held together, part of the mine case above water. Outside the anchor is a 90-pound plummet, containing a reel of ⅛-inch diameter steel wire "plummet cord," made the same length that the mine is to be below the surface. Thus, if the mine is to be 160 feet beneath the surface, the cord is made 160 feet long. The plummet drops off when the mine goes overboard, unreels its cord, coming to the end with a jerk

that trips the slip hook which holds the mine and anchor together. The pull on the cord also lifts the latch on the reel inside the anchor, allowing the mooring wire to unwind. The nearly solid plummet tends to sink faster than the more bulky anchor, thus keeping the cord taut until the plummet strikes bottom. The cord then at once slackens, releasing the latch, locking the reel, and preventing any more mooring wire unwinding. The anchor, continuing to sink, pulls the mine under until the anchor strikes bottom. The mine is thus finally moored always at the desired depth beneath the surface, no matter how irregular the ocean bed may be. The mine cases are buoyant enough to pull straight up from their anchors ordinarily, but in a current they are swayed away from the vertical, which dips them down somewhat deeper than intended. For this reason, any locality where the currents are strong is unfavorable for a minefield—one of the difficulties the British Navy had to contend with in closing the Dover Strait.

The new mine having, by October, been carried past the experimental stage as to its principal features, by the Naval Torpedo Station at Newport, R. I., some important mechanical details of the mine yet remaining were now worked out by the *Baltimore*, Captain A. W. Marshall, working directly under the Bureau of Ordnance. By the time complete units were ready, the *Baltimore* had been sent abroad, so the proof testing devolved upon the *San Francisco*, Captain H. V. Butler. This came in March and April.

No throw of the dice was ever watched more intently than those first proof tests. Upwards of forty million dollars had been staked on them and were already half spent. Results on the first day made us feel easy, but it was two days more—from various delays—before we succeeded in exploding a full loaded mine. This had been planted in Chesapeake Bay, well marked and guarded, in the very same deep hole where a whirlpool effect troubled the German submarine *Deutschland* on her first return trip. It was not possible to place the mine far from the fairway, however, since the water elsewhere was not deep enough for our purpose. Early the second morning, the battleship *Arizona* came along, heading too near it. The signal "You are standing into a minefield!" sent her rudder hard over and engines full speed astern. We could see the mud stirred up, from two miles away. Since we could not get the mine up, what a relief it was when it was set off at last by sweeping!

The final proving of the mine as a whole, which was completed in April, off Cape Ann, did not take place until after several cargoes of mine parts had been shipped abroad, but the mine's success, from its first trials, showed how careful and observant had been all those who were concerned in its designing and testing.

The prospect in October was that the shipment of mines would begin in January, but through delay in completing the detailed plans and from the abnormal industrial conditions prevailing, these shipments did not attain a regular flow until May, so that the ships and the mines were ready together.

Secrecy, as well as timely delivery, caused the manufacturing to be partitioned among 500 contractors and sub-contractors, some of them as far west as the Mississippi. Certain mine parts from different makers were put together by still others, and all parts flowed toward Norfolk, Virginia, the trans-Atlantic shipping point. Planning this dividing up, placing the contracts, and arranging for the inspection of all—taking into account the transportation involved and the many different kinds of firms—wire rope makers, automobile concerns, foundries, machine shops, electricians, die-presses, and even candymakers—it was indeed a complex web. What tireless industry and what endless patience under pressure went into this work, only Commander Fullinwider and his assistants can fully appreciate.

A large plant to charge the mines with explosive was built alongside the Naval Magazine at St. Julien's Creek, near the Norfolk Navy Yard. This plant was of capacity larger than any other of the kind, ample for handling 1000 mines a day. The high explosive was melted in steam kettles to about the consistency of hasty pudding, and drawn off, 300 pounds of TNT at a time, into the mine spheres. An automatic device shut the flow off at the right weight, and a mechanical conveyer carried the mines along slowly, to the pier end, by which time they would be cool enough to load into the waiting ship. Hot work around those steam kettles through the long summer! A quiet but important corner, handling 25,000,000 pounds of TNT, with constant risk from fire. Several of the sailors were overcome by the kettles' poisonous fumes, and one died. The duty was monotonous and inconspicuous but was done with praiseworthy faithfulness.

CHAPTER FIVE

General Supplies and Transportation

Under the extraordinary demand prevailing abroad for food and all kinds of military material, it was only fitting that ordinary supplies for our part of the Northern Barrage operation should come from America, British sources to be used only for fuel and fresh provisions. Details are needless here, except to mention their completeness—largely due to the efforts of Captain G. C.

A Mine Carrier Steamer.
Twenty-Four of These were Constantly Employed to Transport the Mine Parts Over to Scotland for Assembly and Laying.

Schafer of the Pay Corps. After starting things fair at home, he sailed about mid-December for England, where the needs of the bases could be best determined. With him went Assistant Paymaster R. N. Smither, U. S. N. R. F., who later became his successor, and Lieutenant Thomas Newhall, U. S. N. R. F., who had been enrolled for duty principally in connection with transporting the mine carriers' cargoes across Scotland. His experience in railroading and his tactful energy made a valuable asset. After their departure, purchases and deliveries were followed up indefatigably by Assistant Paymaster A. B. Peacock, U. S. N. R. F., who was quite successful in bringing pressure to bear effectively. One morning, after a certain freight car had been missing for two weeks, he reported that eight railroad presidents were

now interested personally in the search—and the car was then found.

For transportation beyond the seaboard, cargoes of mines must go in special ships, which could carry also the general supplies for the operation. The mine carriers should be small rather than large, to minimize the effect on the progress of the operation in the event of losing one. About 60,000 tons in constant employment being needed, 24 of the so-called "Lake" steamers were selected, built on the Great Lakes for coastwise service, of 2500 tons average capacity. They were armed against submarines, manned by naval crews, and would sail in convoy, two or three every eight days, beginning in February. Their fitting out and management came under the Naval Overseas Transport Service, which furnished them according to schedule. Slow speed, due to their small size and cheap build, made them good prey for submarines, which sank one of these carriers in April, the *Lake Moor,* with 41 of her crew—almost our only loss of life in the whole operation. This was another part of the whole operation that was obscure, though all-important, which would yet have been very conspicuous had it not been so well done.

The great amount and the dangerous nature of these cargoes needed special arrangements for embarking them, for which Southern Railway Pier No. 4, at Pinner's Point, opposite Norfolk, Virginia, was taken exclusively. This pier being large enough to assemble several cargoes at once, the entire cargoes could be loaded there, and that was the plan, until the great disaster at Halifax aroused strong local opposition concerning the place of loading the mines on board. It was too late then to relocate the plant for charging the mines with TNT, and as the ground of local opposition was undeniably well taken, a real problem was presented. To take the loaded mines in lighters from the magazine 17 miles to the Explosives Anchorage, as first proposed, would have been very slow—almost impossible in bad weather—even had ample towage, lighterage, and labor been available, besides involving an extra handling for every mine, with attendant damage and risk. Thanks to the timely exertions of Captain W. J. Maxwell, U. S. N., who was in general charge of the loading and despatch of mines, a channel was dredged up to the magazine pier, where the steamers could embark the mines directly, after loading

the unobjectionable part of their cargoes at Pier 4. Thus local interests were quieted with the greatest measure of safety.

Several ingenious arrangements were devised for handling the mine material quickly. Two mine anchors fastened together. 1600 pounds, could be trundled about by one man, making a considerable labor saving on loading 2000 in one cargo. The pier became also the sub-assembly point for some mine parts, requiring a shop, as well as shipping organization. All was done by naval enlisted men, under the supervision of Lieutenant A. J. Love and Lieut. Commander R. E. Corcoran (P. C.). It was not long before these steamers began to take supplies also for our Battle Squadron with the Grand Fleet, 500 tons at a time.

CHAPTER SIX

A SAMPLE OF QUALITY

While details were shaping for proving the mine early in March, an urgent request came from the British Admiralty for one or more minelayers to help lay a field in the North Irish Channel. This passage was used by slow convoys to the west coast, making port first at Lamlash in the island of Arran, and submarine activity here needed to be checked. The sinking of the *Tuscania* had taken place in this vicinity.

At that time, only the *San Francisco* and *Baltimore* could be considered for this duty, and as the former was flagship, the *Baltimore* was sent. To " How soon can you go? " over long distance wire, Captain Marshall answered " Right away," guessing at he destination, and on March 4 he sailed from New York to join I. M. S. *Leviathan* as escort for a fast convoy out of Halifax.

By popular standards, the *Baltimore* was a musty back num-r—years older than many of her officers and crew—but she had en at Manila Bay with Dewey and had otherwise distinguished rself in a long and varied career. Though classed as a poor amer, the ease with which, time after time, she produced extra ed at a pinch was a standing joke. Thanks to a good overhaul ly in the war and to the ability and contagious enthusiasm her engineer, Lieutenant R. P. Molten, U. S. N., she now ped a 9-day transatlantic run at 13 knots, for the most part rough weather, with a three-hour spurt at 18.6 knots—2 knots ter than was supposed to be safe for her engines—just to keep e with the *Leviathan.*

he arrived at Greenock, Scotland, March 17, ready for work. was so much earlier than expected that her first mines were delivered until April 13. Without any preparatory trials. gh the mines were British, of a type new to the *Baltimore*. vent out at once, beginning the deep minefield between the of Islay and the Irish coast, which was to prevent sub-d but not surface passage.

e mines in excess of her reported capacity having been sent 10 had to be carried on the upper deck, and the last one e mines, in going down the elevator, was jambed, due to

laying—and five safety devices were seen in place and in orde
These devices would prevent the firing mechanism working un
the mine had reached a certain minimum depth under water a
had been in the water about 20 minutes, and would also preve
exploding in case of loss overboard during embarking. Su
devices usually function properly, and dependence is not plac
on one alone but on several together, any one of which will mak
the mine safe to handle—by experienced men. At an early stag
in the training in mines, one learns to treat them with respec
always—no liberties. Even the safest explosives, the surest mechanism, have an occasional, inexplicable aberration.

LOADING MINES INTO LIGHTERS.
At Base 18, on the Caledonian Canal, at Inverness.

The ready mines are swung up into open freight cars, for hauling to the water side, whence they go, 40 to 80 together, in lighters out to the ships. After being landed on the tracks of the minelayer, one safety pin is removed—leaving four—and the mine is then examined for any derangement during the three handlings in transit from the store shed.

The north of Scotland was a barred area, yet it was reported possible for information to get through to the enemy in 18 to 20 hours—time enough for interference to hatch out. With so much activity at the bases, lighters going to the ships loaded and returning empty, and a large destroyer escort coming in on 5 June, the

CHAPTER SEVEN

MINE ASSEMBLING AND EMBARKING

Following the conference on board the *Queen Elizabeth*, our bases worked full blast on the mines for the first operation. One group assembled and tested the anchors, another the mines, a third the plummet, a fourth the plummet and anchor together, and a fifth, the final assembly, of mine and anchor complete—called a unit. A section of mine track of standard gauge sufficed to test the anchor wheels and thus obviate trouble on board from their binding or dropping between the ship's tracks during mine-

MINES AND MINE ANCHORS AWAITING ASSEMBLY.
The Anchors were Shipped in Pairs, for Convenience in Handling.

laying, possibly causing an interrupted string. It speaks well for the manufacture, for the testing at the bases, and for the ship's mine track installations, that no such interruption ever occurred in the whole series of operations.

The adjustment of firing mechanism was done in a locked room, the secret entrusted only to a few. It was delicate work, to be done patiently and methodically, for its accuracy determined whether the mine would be alive—or a dud. Fidelity in such adjustments is hard enough to maintain when the repetitions are numbered only by tens. Where hundreds and thousands are involved the tax on attention becomes severe.

Before loading the mines into the cars, for transfer to the lighters, each mine was primed with a mealed TNT "booster" charge and the firing detonator was put in place—all ready for the

omission of signals or delay in them." Otherwise there would be gaps in the barrier, impossible to fill without waste of time and space, and mines would be brought back that should have been planted. Teamwork in the high degree wanted meant every man alive to his interest in the general result and sensible to his responsibility for his part in it. All would learn this in time, but it must be driven home beforehand. It was of utmost importance that the first operation should be an unquestionable success.

Accordingly, after making the preliminary inspection of each new ship, I spoke to each ship's company, partly to comment on their work so far, but chiefly to enlist the best efforts of each individual. Rumor and conjecture were the sources of all they had learned hitherto of the work ahead of them. Now they were told something of its magnitude and importance—that it had been regarded as doubtful of accomplishment, but their squadron commander had promised success in their name, promised the kind of success that comes only with the best teamwork throughout the ship and by all ships in the squadron. Every man should realize that now, in war, his utmost was called for, as never before in his life; that however simple and unimportant his duty might seem, it was his to do, and he was counted on not to be content that any other man's work should be better done, and that, in our work, prolonged through hours, the attention must never slacken—the 600th mine must be as carefully tended as the first. The men gave the closest attention—not an eye wavered, hardly a muscle moved—giving back such confidence that, on board the *Canonicus*, which I had found in fine condition, I could wind up with, "And when the last mine is out, the only signal I expect to send to you is '*Canonicus* well done'!"

CHAPTER EIGHT

THE FIRST MINELAYING EXCURSION

The eve of our first departure was drizzling and misty. Attempts for some advance sleep were of no avail—too much pressure had directly preceded. When 11 o'clock came without sign of the two ships due from the inner anchorage in Beauly Basin, we in the flagship wondered why. The tide was falling, another half hour passed—would they never come? Signals and radio failed to get through. Very soon, if not already, they would be unable to pass through the new dredged channel. At last, near midnight, they appeared. The pilots had been delayed through a misunderstanding on shore, in itself slight—but it was a narrow escape from being 10 hours late, which, on our first operation, would have made a bad impression, without and within.

The start is made without signals, all dark and noiseless on board, except for the rumbling chain as the ship gets underway. As the *San Francisco* heads out slowly, one after another the signal quartermaster reports the other ships underway and following. We take two-thirds speed now. The full number of lookouts are at their stations and warned to be alert, and the men are now sent to the battery, making a little stir for the moment, then quiet falls again. Fort George shows the signal for an open gate, we increase to standard speed, and as the second ship passes out through the submarine net, they all form single column astern and close up—to 500 yards apart. The rocky shore looms high and black on the left, not a single house light showing. On the offshore side, small patrol craft can be dimly seen, on watch against lurking danger. Fifteen minutes more and we see long, low forms slinking against the dark background of North Sutor. Those are the escort destroyers, going out to form a screen. Close following them we make out larger, higher, moving shadows—our detachment from the other base—one, two, three, four—*five! All there!* The detachments are so timed that they reach the junction buoy at the same moment, and the whole squadron stands on, without pause, together, 10 ships in two parallel columns, 500 yards apart. Ahead and on either side are four destroyers, 12 in all. No signals, no lights, no sound but quiet tones on the

bridge and the swash of the water overside. Three miles along, the water deepens to 60 feet. A screened flash from the flagship to the opposite leader and the squadron, all together, slackens speed, to get out paravanes—those underwater, outrigger-like affairs which guard against anchored mines in one's path. Only a few minutes, then up each column comes the sign "yes," passed by ships in succession—another flash from the flagship, and we resume standard speed again, keeping on, out Moray Firth, through the one-mile wide channel, which is swept daily for mines.

THE MINE SQUADRON AT SEA.
Returning to Base After Laying the Ninth Minefield.

Off Pentland Skerries, near John O'Groat's House, we turn east, and here as we pass, the supporting force files out of Scapa Flow—six light cruisers, then a squadron of battle cruisers and another of four battleships, each squadron screened by six destroyers. Very impressive are these great ships, majestic in movement, as they sweep off to the southward and eastward, disappearing in the morning haze, which magnifies their towering bulk. We see them no more until next day but know they are there, on guard against raiders.

The British Minelaying Squadron is out, too, four ships with a joint capacity of 1300 mines, but we do not meet. Though protected by the same heavy squadrons, we work independently, in different areas. They are bound this time for the section near the Norway coast, Area C it is called, while we are to begin at the southeastern corner of the middle section, Area A, and work to the westward.

Straight over to Udsire we go, a small island off the Norway coast, the nearest good landmark from which to take a departure for the minelaying start point. We make Udsire Light near 11.30 p. m., close in to about 11 miles distance, turn north for a sufficient run to give a good fix, and then head off-shore. Accurate determination of the minefield's position is necessary for use in laying another field close by subsequently, and also for the safety of the vessels sweeping the mines up after the war. There must be steady steaming and steering, with a minimum of changing course—no hesitation, no trial moves, for neither the time at disposal nor the submarine risk will permit.

All goes smoothly until the turn to head off-shore, when one destroyer crosses too close under *San Francisco's* stern and cuts her "taut wire." This is fine piano wire, furnished in spools of 140 miles of wire, the whole weighing one ton. A small weight would anchor the end to the bottom, and then a mile of wire meant a mile over the ground without question.

The wire is soon started again, and as the *Baltimore* is running her wire on the other flank, and the weather is clear enough for good navigational bearings and star sights, no harm is done. We head for a position seven miles in advance of the start point, so that the squadron may turn together to the minelaying course and have still a half-hour in which to settle down.

It is a busy night and early morning, keeping the ships in formation, verifying the navigation, keeping a keen lookout in every direction for submarines—we are now in their regular route—going over the mines for final touches and making other preparations necessarily left to the last. About 4 o'clock, Lieut. Commander Cunningham, the flagship's navigator, reports that we shall reach the start point at 5.27 a. m. Captain Butler and I check his figures, and at 4.27 the signal is made that minelaying will begin in one hour. The crews go to mining stations, to see all clear and then stand by. In the flagship we watch for the

reports of readiness. Ship by ship they signal in the affirmative. They are ready, every one.

Now the last turn has been made and the signal is flying to begin laying in seven minutes. The ships are formed in a single line abreast, speeding towards the start point—like race horses when the starter's flag is up. It is a stirring sight. How will it go, after all these months—for some of us years—of preparation? Our work to-day will mean much to those in Washington.

No ship is off the line by so much as a quarter length. Commander Canaga stands with watch in hand—" two minutes, one minute, thirty seconds, fifteen?" He looks up inquiringly. A nod—all right. "Five seconds—haul down!" Up go the red flags on the first ships to plant, the sign that their minelaying has begun, and word comes from the flagship's launching station at the stern, "First mine over." All well so far.

The minelaying now runs entirely by the time table. Each ship gives her successor five minutes warning and, as her last mine dives overboard, shows the signal "Begin minelaying at once; I have suspended." The successor begins accordingly, showing her red flag. The staff officers on board the *San Francisco* watch for these signals, comparing the times with what they should be, and counting also the seconds elapsed between the launching of successive mines, from the ships whose sterns we can see. A few seconds out now and then—otherwise all goes according to schedule, just as planned before leaving the United States.

The hardest task is on board the *Housatonic*—a new ship, with a new mining installation, of type untried in service, and a crew inexperienced in minelaying—dropping 675 mines without intermission, 1 every 11½ seconds, during 2 hours and 10 minutes. Her mate is standing by, ready for any interruption, but the *Housatonic* completes the task without a break—making a world record, a continuous line of mines, 28 miles long. On a later occasion, the *Canonicus* planted 860 mines in 3 hours 35 minutes, an unbroken line of 43 miles.

About 20 minutes after planting began, an explosion was felt and a geyser seen astern. A few minutes later the same occurred again, and other explosions followed, at varying intervals and distances, some just visible on the horizon. Others which were nearer, as evidenced by the sharpness of the shock, threw up no geyser, indicating that they were at the middle or lowest depth.

In the proof tests held off Cape Ann in April, it had been observed that a mine at the middle level, 160 feet submergence, made no surface disturbance when detonated, until 8 seconds had elapsed, and then only as much as the wash of a light swell over a submerged rock. At the deepest level, 240 feet submergence, a detonation produced no more surface upheaval than there is in a glass of well iced champagne. The ship being about 800 yards away, the shock was heavy and sharp. The water surface all over could be seen to tremble with the shock, but directly over the mine itself, when, after 27 seconds, the gas came up, there was no more surface disturbance than a pleasure canoe could have ridden with safety. A slick on the water would follow, but this could not be distinguished at much over a mile distance nor at all if there were a white cap sea running.

Observers recorded the number, times, and approximate positions of all explosions and, on board the *San Francisco* and *Baltimore,* there were listeners stationed at the submarine signal receivers, so as to get a full count. All observers did not agree, as the indications from sounds and shocks varied according to distance and depth. Some explosions gave a prolonged reverberation, at times sounding to the unassisted ear like two or three explosions in rapid succession, but in the submarine signal receiver each explosion made a distinct sound, unmistakable.

The count by the *San Francisco* and *Baltimore,* differing by only 2, practically agreed on 100 explosions, or about 3 per cent of all mines planted. Although a perfect record was desirable, the detonations showed the minefield to be alive and sensitive, and their number was not large for a new mine, not yet long enough in service to refine out the minor defects.

Surprising enough on deck, where one could see, that first explosion must have startled the men in the engine room, in the coal bunkers, and on the lower mine decks. The blow rings sharper down there, where resulting damage, in broken pipe joints or started boiler tubes, might be expected first. Whether gun, torpedo, or mine, however, it is all one—the duties go on just the same.

As the mines on the launching deck move slowly aft, those on lower decks move forward, to the elevators and up. Working spaces are cramped, passages narrow, bulkhead doors closed wherever possible. At the right time, a door will be opened, the

portable section of mine track adjusted, the mines in that compartment hauled out, and the door closed again water-tight, all as quickly as possible. Close, hot, foul with oily steam and seasickness—it is sweating, disagreeable work below decks. But complaint is nowhere in the ships. The feeling is well expressed by one man, writing home:

When the first mine went over, I had a curious feeling of exultation. The fear, the perils, the uncertainties that surround our work, slipped from me like the foolish fancies of a nightmare. There, at last, was a nail in the Kaiser's coffin. Come what might, I had justified my existence. Had the whole German High Seas Fleet appeared in the offing, I am sure I should have gone to my battle station with a shout of glee.

Prolonged activity, in preparing the squadron and bringing it out, makes it trying now for me, to look on, hands folded—nothing to do while everything goes well—yet constantly alert, for instant decision in case of mishap. After nearly four hours, the schedule is finished. Some marker buoys are dropped, for later use in beginning another minefield. The line of ships then takes the narrower route formation, and we head back for the base. Butler, Canaga, and I exchange quiet congratulations. Our work together has been to good purpose.

The men clean up the decks, get a wash for themselves, and those off duty drop asleep—anywhere—the deck is covered with them. On top of the duties common to all men-of-war, to move the 400-ton masses of mines, in slow but steady time, is very fatiguing, even with steam winches to help.

We are not finished yet. Expectation of a quiet afternoon doze, handy to the bridge, is rudely dispelled by a smoke screen started by the destroyers. Unaware it is only an exercise, all hands tumble up to battle stations. Then one minelayer must stop, to tighten a nut working loose. Two destroyers are left to guard her, all three overtaking us in a few hours. Next a dirigible balloon heaves in sight, and then a widespread smoke covers the horizon, developing into a convoy of 50 vessels. Finally, in the midst of dinner, the siren of our next astern shrieks "Submarine to port!"

While the minelayers, upon signal, swing together away from the danger quarter, the *Vampire* swoops by at 30 knots, to drop two depth charges on the spot indicated. Captain Godfrey signals, "Whatever was there, those charges will keep him down for a

considerable time." All quiet again, we return to our cold provender, remarking that, as a name, mine squadron is ill chosen. It should be "Crowded Hour Club."

Reports had now come in from all the ships that there had been no casualties. All were prepared to undertake another operation upon receiving the mines, and without further incident we returned to our former anchorages, arriving at 3.30 next morning. But ere that day closed, so memorable in our lives, I signaled the squadron:

The operation to-day was an excellent performance by each ship and by the squadron as a whole. The fact of some premature explosions does not detract from the highly creditable mine handling and steady steaming. Confidence in the personnel and faith in the undertaking are well justified, and captains may well be proud of their commands, as the squadron commander is of the squadron.

SQUADRON ORGANIZATION AND SHIPS' DATA

MINE SQUADRON ONE, U. S. ATLANTIC FLEET

(Designated in H. B. M. Grand Fleet, SECOND MINELAYING SQUADRON)

Captain Reginald R. Belknap, U. S. N., Squadron Commander

Flagship—U. S. S. *San Francisco*

Chief of staff....................*Captain H. V. Butler.
Aid and tactical officer............. Commander B. L. Canaga.
Squadron construction and mining officer ....*Comdr. L. F. Kimball.
Squadron engineer ....*Lt. Comdr. F. R. Berg.
Squadron engineer from 1 October, 1918 ....*Lieut. G. J. Blessing.
Flag lieutenant and secretary...... Lt. Comdr. E. S. R. Brandt.
Aid and secretary after 23 August, 1918 .... Ensign Roger F. Hooper, R. F.
Squadron radio officer, also signal officer after 23 August, 1918.... Lieut. R. C. Starkey.
Communication officer and aid..... Lt. (j. g.) R. L. White, R. F.
Squadron surgeon ....*Lt. Comdr. G. C. Rhoades (M. C.).
Squadron surgeon from 1 October, 1918 ....*Lieut. H. P. Stevens (M. C.), R. F.
Squadron supply officer...........*Lieut. C. R. Eagle (P. C.).
Squadron athletic officer...........*Lt. Comdr. G. W. Hewlett.
Assistant squadron construction officer ....*Lieut. G. R. Arey (C. C.).

San Francisco (flagship)—Captain H. V. Butler, U. S. N.

Launched at Union Iron Works, San Francisco, October 26, 1889, as a protected cruiser; commissioned as a mine ship August 21, 1911; length 324 feet, beam 49 feet, extreme draft 24 feet, full load displacement 4583 tons; twin screw, 18 knots; four 5-inch 51-caliber guns, two 3-inch anti-aircraft guns, 170 mines; officers 22, crew 350; additional for flagship, officers 5, enlisted men 47; total on board 424.

Baltimore—Captain A. W. Marshall, U. S. N.

Launched at Cramp's Shipyard, Philadelphia, October 26, 1888, as a protected cruiser; commissioned as a mine ship March 8, 1915; length

* Additional to ship duties.

335 feet, beam 48½ feet, extreme draft 24 feet, 5482 tons; twin screw, 18 knots; four 5-inch 51-caliber guns, two 3-inch anti-aircraft guns, 180 mines; officers 21, crew 339; total 360.

Roanoke—Captain C. D. Stearns, U. S. N.

Launched August 30, 1911, named *El Dia;* commissioned as a minelayer January 25, 1918, at Tietjen and Lang's Shipyard, Hoboken, N. J.

Housatonic—Captain J. W. Greenslade, U. S. N.

Launched November 14, 1899, named *El Rio;* commissioned January 25, 1918, at Tietjen and Lang's.

Canandaigua—Captain W. H. Reynolds, U. S. N.

Launched in May, 1901, named *El Siglo;* commissioned March 2, 1918, at the Morse Dry Dock and Repair Company, Brooklyn, N. Y.

Canonicus—Captain T. L. Johnson, U. S. N.

Launched November 14, 1899, named *El Cid;* commissioned March 2, 1918, at the Morse Yard.

All four preceding were built at the Newport News Ship and Engine Building Company, Newport News, Va., as freight liners for the Southern Pacific Steamship Company (Morgan Line). Length 405 feet, beam 48 feet, draft 20 feet, displacement 7000 tons; single screw, 15 knots; one 5-inch 51-caliber gun aft, two 3-inch anti-aircraft guns forward; 830 mines normally, 900 maximum, carried on three decks; officers 21, crew 400; total 421.

Quinnebaug—Commander D. Pratt Mannix, U. S. N.

Launched October 14, 1898, named *Jefferson;* commissioned as minelayer March 23, 1918, at Robins' Dry Dock and Repair Company, Brooklyn, N. Y.

Saranac—Captain Sinclair Gannon, U. S. N.

Launched in 1899, named *Hamilton;* commissioned April 9, 1918, at James Shewan & Sons, Inc., Brooklyn.

Both were built by John Roach & Sons, Chester, Pa., as coast-wise passenger and freight liners for the Old Dominion Steamship Company; length 375 feet, beam 42 feet, draft 18½ feet, displacement 5150 tons; single screw, 16 knots; one 5-inch 51-caliber gun aft, two 3-inch anti-aircraft guns forward; mines 612 normally, 642 maximum, carried on two decks; officers 18, crew 392; total 410.

Shawmut—Captain W. T. Cluverius, U. S. N.

Aroostook—Captain J. Harvey Tomb, U. S. N.

Both vessels were launched in 1907 at Cramp's Shipyard, Philadelphia, named *Massachusetts* and *Bunker Hill* respectively; commissioned as minelayers at Navy Yard, Boston, Mass., December 7, 1917; length 387 feet, beam 52 feet, draft 17½ feet, displacement 3800 tons; twin screw, oil fuel, 20 knots; one 5-inch 51-caliber and one 3-inch anti-aircraft gun on the middle line aft, one 3-inch anti-aircraft gun forward; 320 mines normally, 352 maximum, all carried on one deck; officers 20, crew 346; total 366.

Totals of Squadron:

Tonnage, 54,000 tons.

Mines, normal 5530, maximum 5834.

Officers 208, men 3839; total 4047.

In addition, four sea-going tugs belonged to the squadron, as described in Chapter 22.

(TO BE CONTINUED)

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ALLEGATION OF SNOBBISHNESS—OUR RESPONSIBILITY—AND SUGGESTIONS TENDING TOWARD ITS ERADICATION

By Commander B. B. Wygant, U. S. Navy

There exists in this country a distinct prejudice on the part of some people against naval officers, particularly graduates of the Naval Academy, on account of a snobbishness that is alleged to obtain among them. This feeling is shown in speeches made in Congress, and in articles that appear now and then in various periodicals. These speeches and written articles are generally by men whose facilities for observation are limited and who have drawn their conclusions by applying their own experience and feelings to conditions that can only be superficially understood by those who have not, at first hand, seen the necessity for discipline and its forms.

This feeling is rather more widespread than most of us realize, as is shown by the reception accorded its expression, and by the character and circulation of the periodicals in which the articles appear. It cannot fail to do the service injury if something is not done to counteract it. Although it would unquestionably practically disappear if we had universal service, we have not as yet, and we must face present facts and not concern ourselves with hypotheses.

The fact is that the idea of snobbishness among naval officers exists; that it is fairly widespread among the uninformed; that it is being constantly spread with no very effective attempt at contradiction; and that it lessens the esteem in which the service is held by the country at large.

As regards an idea, it matters little in the effect produced whether or not it be correct: far too often it is what things seem to be that counts, and not what they are. Therefore, if we seem to have this defect, as far as those are concerned who see it in us we *have* it, and it behooves us to correct whatever shortcom-

ings do exist, and to remove the false impression by every effort in so far as it is false.

Let us in the first place critically examine ourselves and our acts and ascertain if there is any proper foundation for this belief. It was a matter of surprise and somewhat of a shock to find out, after frankly interrogating several reserve officers, that many of them had gained the impression that officers of the regular service are snobbish, particularly (did they say) recent graduates of the Naval Academy. Further questioning usually elicited the fact that this impression could be traced to one of two causes: Failure on the part of the individual to adapt himself to military methods, or tactlessness on the part of naval officers with whom he had come in contact. It appeared that young officers who had had the four months' course at the Naval Academy fitted more easily into naval life, and consequently did not feel the irritation caused by the exactions of discipline, experienced by those who had not had the benefit of this training.

If this be a correct deduction it is enlightening in that it shows the necessity for inculcating a strict sense of discipline before an officer (or an enlisted man for that matter) is thrown into the intimate contact of service afloat.

Of course there are those whose home training has instilled the respect for authority that is so much a part of our naval life, but unfortunately this is not universal.

Tactlessness on the part of those in authority is a prolific source of irritation with its consequent harmful results Take the case of an admonition, a reprimand or the refusal of a request that leaves a needless sense of resentment. It does harm, for resentment is like sand in the gears, it impedes progress.

To these two things, ignorance of the requirements of discipline, and tactlessness on the part of seniors, is to be attributed in part this more or less widespread attitude of disapproval on the part of many people.

Let us be perfectly honest with ourselves and realize that whatever is wrong with the navy, is, except where influenced from outside sources or where compromise is forced upon us, the fault of the navy, and that means naval officers.

Our best advocates should be those who have been in the service and leave it to enter civil life, and those civilians who come into intimate contact with the navy in business or otherwise.

What, then, can be done to remedy the state of affairs, considering the two main causes of friction, and the fact that it lies within our means to eliminate them to a large extent?

First, let us be more careful in the training of officers and men to inculcate the right ideas. Pains should be taken carefully to explain the necessity for prompt obedience, respect for authority and cleanliness and neatness of person. This instruction should not cease with the training station period. For example liberty parties should have it continually brought before them on leaving the ship that they represent the navy and their own ship, and that their actions reflect credit or discredit as the case may be. This also infers a careful inspection as to uniform and the wearing of the proper cap ribbon. Division officers should constantly instruct their men in the meaning of the salute. I have spoken to many men regarding failure to salute when on shore and their answers usually divide them into classes—those who honestly were not aware of my presence and those who tried to "get away with it" through an aversion to saluting. In nearly all cases of the second type proper instruction would have prevented the infraction. If men could only be taught the proper meaning of the salute—and they can be—it would be a matter of pride to salute.

To be more specific: The psychology of the salute should be better studied, by officers and men. Make it understood that a junior meeting a senior in effect says to himself: "There is one, my senior in this honorable profession to which we both belong. I am proud to salute the uniform he wears for it represents the authority I am pledged to obey—the expression of the will of my country. In saluting I am publicly acknowledging my allegiance to my flag." The senior in returning the salute says: "There is one who belongs to the same honorable profession as myself. He is saluting the uniform I wear on account of what it means. As the wearer of that uniform I am proud to return the salute, and in doing so acknowledge his loyalty as thus expressed, and publicly proclaim our common allegiance."

Let us get rid of the hang-dog look that so often accompanies the salute, and do away with the careless and sloppy return of the salute by those who do not understand its significance.

These things cannot be done in a short time, they require unceasing attention and constant reiteration. They presuppose a

pride in the service and an *esprit de corps* that it should be the ambition of every officer to foster and maintain.

In the navy personal relations transcend in importance everything else. These relations affect honor, obedience, loyalty—all the qualities that make the difference between victory and defeat. The most powerful guns, the most efficient machinery, the most complete knowledge of strategy and tactics are helpless without the exercise of these qualities. Personal relations are largely dependent on tact—yet how little is this subject considered in the training of officers!

In this discussion it is important that it be quite clear what is meant by tact. For present purposes let us define it as "the ability to deal with others without giving needless offense." It does not necesarily mean saying "please" and "thank you," but it does have to do with the expression of the countenance and the tone of the voice, and above all it requires self-control.

The avoidance of the causes of resentment also requires standardization of methods. In other words tactful administration of discipline implies a standard that is universal throughout the service.

We must all require the highest standard; of conduct, of courtesy, and of appearance.

To consider the official relations of seniors and juniors: There are times of course when it is desirable for the senior to "get mad," but they are rare and each time that it happens its effect is lessened. Have we not—most of us—seen cases where this tendency became undignified and even ludicrous? The same applies to a loud tone of voice when calling attention to an error or administering a reprimand. There are times when a loud tone of voice is necessary, but how much more effective is obvious repression in most instances. I have in mind a certain naval officer who habitually was very quiet when officer of the deck on a sailing ship, but when he did "let out" we midshipmen jumped, and lively, too. There was no mistaking the urgency of his orders.

So with harshness in judging errors due to ignorance or incompetence. If a man doesn't know he should be instructed; if he isn't capable of performing his duties he should be reduced or discharged. That is, in these cases no fault can be justly attributed to the man himself—the fault lay with those who failed to

instruct on the one hand or with those who neglected to ascertain his incapacity on the other.

Paul Jones in his admirable letter emphasized the importance of tact and forbearance.

If there be any foundation in fact for the attitude of those who hold us in disesteem, a thoughtful consideration of the ideas outlined above, and an effort to eliminate whatever needs elimination and to encourage improvement along these lines should tend to remove any just causes of criticism.

It then remains for those of us who have the opportunity to combat by word and example the pernicious misinterpretation to which we have been and are being subjected.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A DESCRIPTION OF THE BATTLE OF JUTLAND

(CONTINUED)

By Lieut. Commander Holloway H. Frost, U. S. Navy

VIII. The Battle Cruiser Action. Move 4. 3.48 to 4.08 p. m. Position 4

At 3.48 the British and German battle cruisers opened fire simultaneously. According to Beatty's report the range was 18,500 yards. The Germans reported an opening range of 13,000 meters. The British report is assumed to be correct. As soon as fire was opened Beatty went ships right simultaneously about 30° and steadied on a course which was probably about 150° true.

At 3.51, only three minutes after fire had been opened, the *Lion* was hit by two shells; by 4 p. m. the *Tiger* and *Princess Royal* had also been hit by several shells. The *Lion* received several more hits and at 4 p. m. the roof of one of her turrets was blown off. The German fire was extremely rapid and accurate, and, the range having decreased by 4 p. m. to 16,000 yards, was having great effect on the British ships. In order to confuse the German fire control the course was altered slightly to the southward at this time.

At 4.06 several projectiles of a salvo hit the *Indefatigable* at the outer edge of the upper deck in line with the after turret. A magazine exploded and the *Indefatigable* fell out of column, sinking by the stern. Another salvo hit her forward and she turned over and sank.

The British fire was also accurate and a number of hits were scored. It is believed, however, that no turret guns were placed out of action or appreciable damage caused.

At about 4.08 the British destroyer *Landrail*, which was on the port beam of the *Lion*, trying to gain her position ahead, sighted the periscope of a submarine. The *Nottingham*, of the second light cruiser squadron, also sighted a periscope.

At about 3.48 the first and third light cruiser squadrons, having concentrated from their positions in the screen, took station astern of the fifth battle squadron.

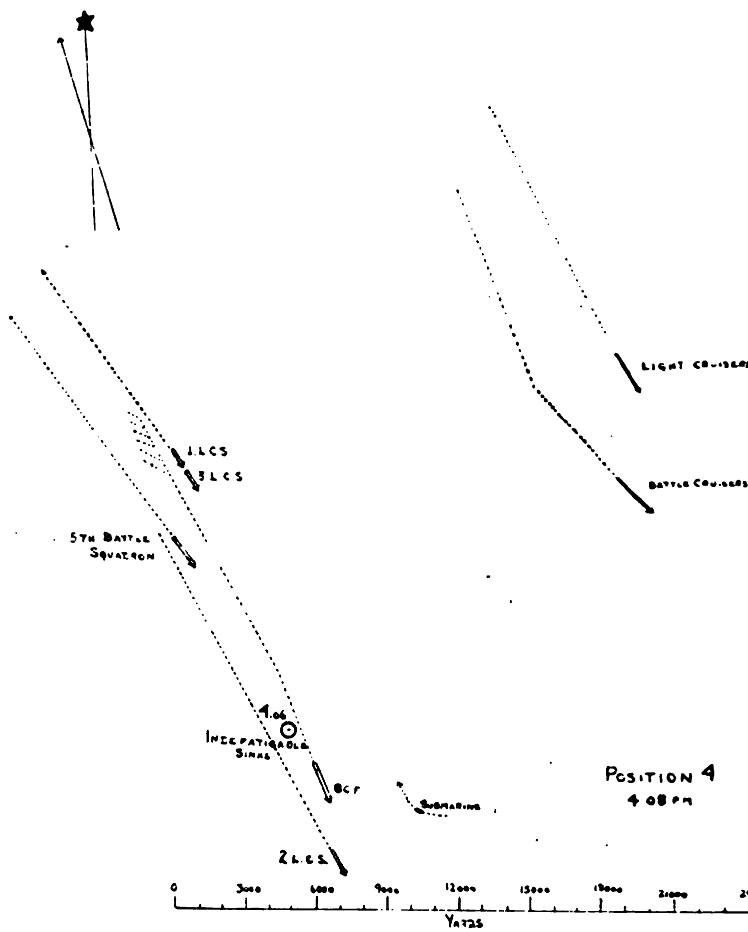


Fig. 8.

At 4 p. m. Admiral Jellicoe directed the third battle cruiser squadron to reinforce Beatty. By this time the speed of the battle fleet had reached 20 knots.

IX. THE DESTROYER ACTION. MOVE 5. 4.08 TO 4.30 P. M. POSITION 5

The action between the battle cruisers continued at gradually increasing ranges. You will remember that at 4 p. m. the British battle cruisers had changed course slightly away from the enemy; the Germans must have also changed course away at this time. Admiral Jellicoe states that the range, which had been 16,000 yards at 4 p. m., had increased to 23,000 at 4.12. By his own sketch, however, it is only 18,000 yards and I assume this distance to be correct, especially as it agrees with the official report of Admiral Beatty. In order to close the enemy, Beatty changed course to 135° true.

At 4.08 the fifth battle squadron opened fire at a range of about 19,500 yards. Only two of the German battle cruisers were visible from the vessels of this squadron, due partly to the decreasing visibility and to the smoke made by the battle cruiser fleet and other vessels ahead. The Germans also frequently laid smoke screens and zigzagged to disturb the British fire control.

At about 4.12 torpedoes were seen passing through the line of the British battle cruisers; they were probably fired by the submarines sighted by the *Landrail* and *Nottingham*. One torpedo passed under the *Princess Royal*.

By this time a number of British destroyers had assembled ahead of the battle cruiser fleet and had been given general instructions by Admiral Beatty to attack when a favorable opportunity occurred. Therefore at 4.15 the following destroyers moved out to attack:

Thirteenth Flotilla:

Nestor, Commander the Honorable E. B. S. Bingham.
Nomad, Lieut. Commander Paul Whitfield.
Nicator, Lieutenant J. E. A. Mocatta.
Narborough, Lieut. Commander Geoffrey Corlett.
Pelican, Lieut. Commander Kenneth A. Beattie.
Obdurate, Lieut. Commander Cecil H. H. Sams.
Petard, Lieut. Commander Evelyn C. O. Thompson
Nerissa, Lieut. Commander Montague C. B. Legge.

Tenth Flotilla:

Moorsom, Commander John C. Hodgson.
Morris, Lieut. Commander Edward S. Graham.

Ninth Flotilla:

Turbulent, Lieut. Commander Dudley Stuart.
Termagant, Lieut. Commander Cuthbert P. Blake.

At the same time that the British destroyers commenced their advance, Hipper, in an attempt to reduce the great superiority of the British since the fifth battle squadron had entered the fight, ordered his destroyers to attack. Accordingly, 15 destroyers ac-

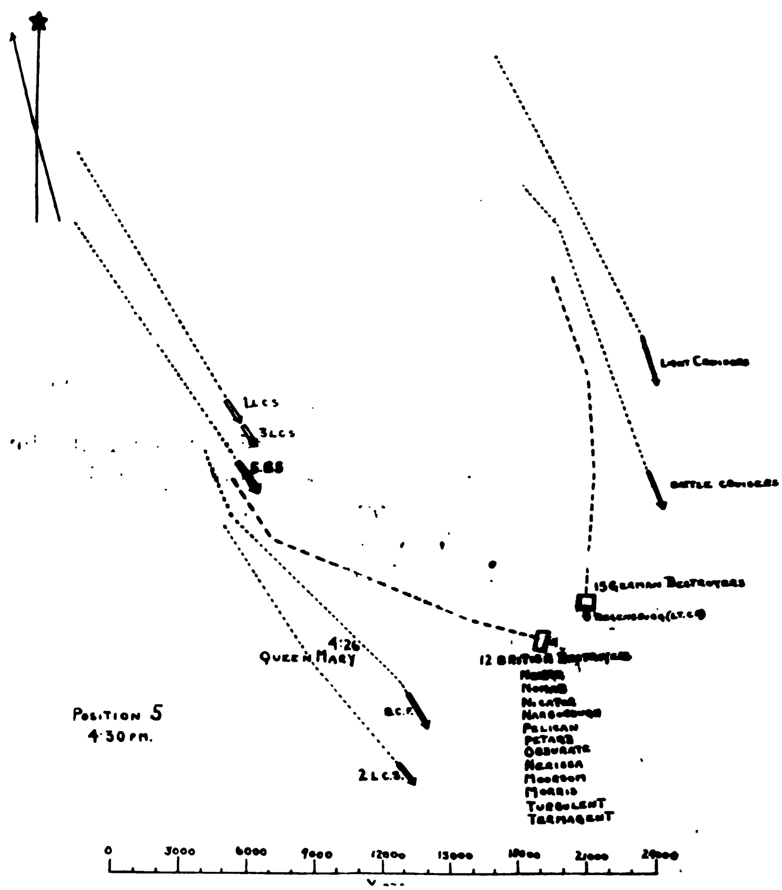


FIG. 9.

companied by the light cruiser *Regensburg* advanced against the British battle cruisers. At 4.30 the opposing destroyers met between the lines and a desperate engagement at several hundred yards' range commenced.

Meanwhile, the change of course of the battle cruiser fleet to southeast had again decreased the range at which the battle cruiser

action was being fought. By 4.18 the range was about 17,000 yards between the battle cruisers and about 19,000 yards between the German battle cruisers and the fifth battle squadron. The action now became very fierce and the fire of both British and German ships was extremely effective.

At 4.18 a fire was noticed on the *Seydlitz,* the third ship in the German column.

At 4.23 the *Barham,* flagship of the fifth battle squadron, received her first hit.

At 4.26 a salvo hit the *Queen Mary* abreast of "Q" turret; a magazine exploded and the ship was completely destroyed; a great amount of wreckage fell upon the decks of the *Tiger,* the next ship in formation. A few of the crew of the *Queen Mary* and of the *Indefatigable* were saved by the British destroyers. Admiral Jellicoe was not informed of the loss of either of these ships until the following morning.

X. THE GERMAN MAIN BODY APPEARS. MOVE 6. 4.30 TO 4.45 P. M. POSITION 6

At 4.30 a most desperate engagement was being fought between 12 British destroyers and 15 German destroyers and one light cruiser. The British destroyer *Petard* fired a torpedo at the leader of a group of three Geman destroyers, hitting and sinking her. Another German destroyer was sunk by gunfire. As the British battle cruisers were well in advance of the German battle cruisers, and as the destroyers on each side may be assumed to have been about the same distance ahead of their own battle cruisers, it will be seen that the British boats had a much better opportunity for making a successful torpedo attack than did the German boats. Therefore, as the British battle cruisers were too far ahead to allow an effective attack on them by the German destroyers, these boats had to be content to fire at the fifth battle squadron. This squadron turned away to avoid the attack, two torpedoes passing through the line without effect.

The German destroyers were forced to retreat before the advance of the British destroyers before their torpedo fire could have any effect other than to delay somewhat the advance of the fifth battle squadron. However, they had to a great extent broken up the attack of the British destroyers, which had been launched from a very favorable position.

Four British destroyers, *Narborough, Pelican, Obdurate* and *Morris,* had fallen so far to the rear that they were unable to fire any torpedoes.

Three destroyers, *Nestor, Nomad* and *Nicator,* were unable to attack from a favorable position on the bow and therefore pushed

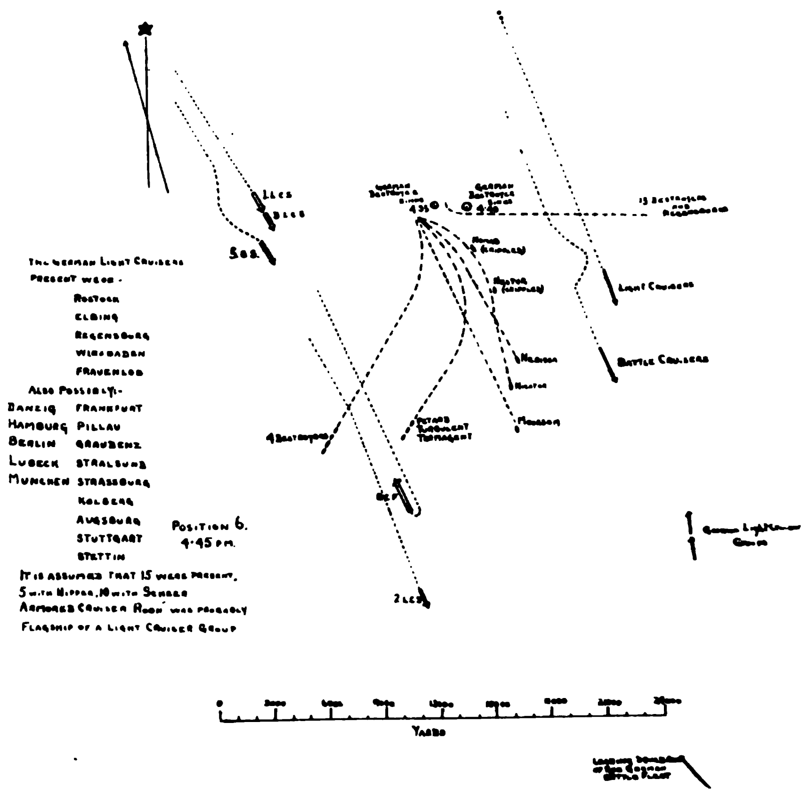


FIG. 10.

home an attack from on the beam of the battle cruisers, which turned away and covered the destroyers with a heavy fire from their secondary batteries. The *Nomad* was crippled by this fire before reaching torpedo range, left the column and lay dead in the water. *Nicator* and *Nestor* fired torpedoes at the battle cruisers at a range of 6000 yards. *Nestor* was then crippled by the fire of a light cruiser, probably the *Regensburg,* and remained dead in the water. *Nicator* rejoined her flotilla.

The *Petard, Turbulent* and *Termagant* also pushed home their attack and each fired a torpedo at the German battle cruisers at a range of 7000 yards.

The remaining two destroyers, *Moorsom* and *Nerissa,* were unable to fire any torpedoes at this time, but continued on to the southward.

During the destroyer attacks the engagement between the heavy ships had been continuing with great fierceness. The effectiveness of the fire, however, had been somewhat reduced by the decrease in the visibility, the smoke of the destroyers between the lines and the fact that the fifth battle squadron and the German battle cruisers had been compelled to maneuver to avoid torpedoes. The German battle cruisers had been forced to use their secondary batteries for a time against the British destroyers led by the *Nestor* and this must have interfered with the fire of their turret guns.

Of the five torpedoes fired by the British destroyers during this period three passed close to the *Moltke* and it is believed that one hit the *Seydlitz,* as this ship, according to a German account published since the armistice, is said to have been hit "at the very beginning of the action." This ship was apparently very little damaged, due to the excellent protective arrangements of the Germans, and continued in the formation throughout the action.

At 4.38 Commodore Goodenough, commanding the second light cruiser squadron, which was ahead of the battle cruiser fleet, reported that he had sighted the German battle fleet bearing southeast (135°) true and steering to the northward at high speed.

Admiral Beatty recalled his destroyers. At 4.42 he himself sighted the enemy and turned his four remaining battle cruisers in succession through 180° to the right and proceeded to the northward "to lead them towards the battle fleet," which was then distant a little over 50 miles.

The second light cruiser squadron kept on to the southward to obtain information of the German battle fleet.

The fifth battle squadron and the German battle cruisers continued for the present in their courses and continued the action.

The accounts of the British destroyer attacks at this time vary greatly. I have accepted as correct Admiral Jellicoe's book, as this is the latest and therefore probably the most reliable authority. Other accounts have been used to supply additional details.

XI. THE GERMAN BATTLE FLEET ENTERS THE ACTION. MOVE 7. 4.45 TO 5 P. M. POSITION 7

At about 4.45 the leading squadron of the German battle fleet opened a heavy fire on the second light cruiser squadron at the short range of 13,000 yards. Commodore Goodenough turned to the

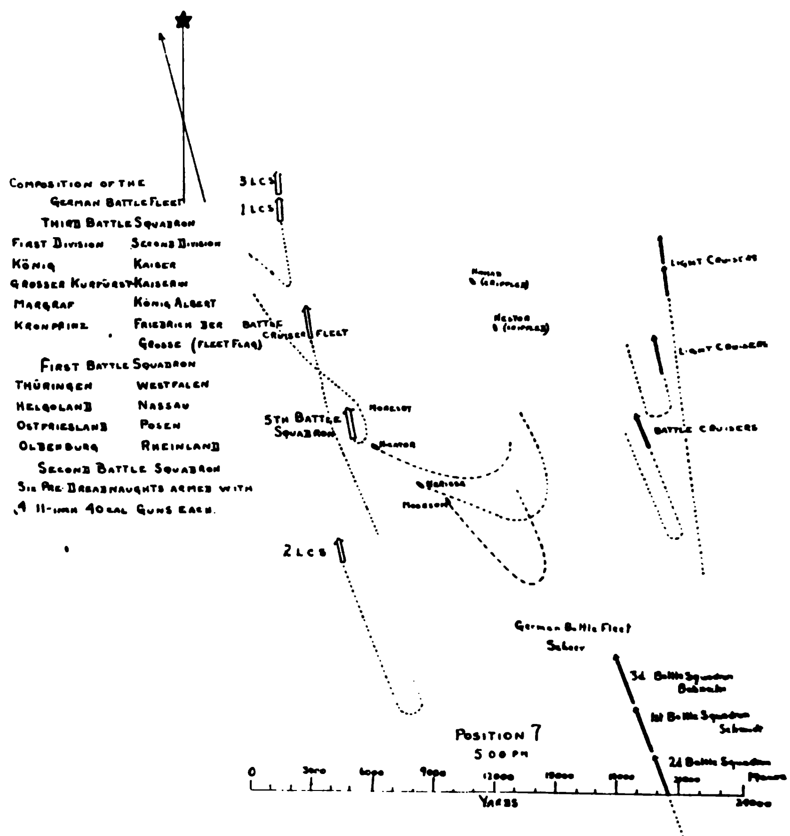


FIG. 11.

northward and continued sending his reports of the German forces to Beatty and Admiral Jellicoe. His escape without being hit by a single shell seems remarkable and seems to show that the gunnery of the German battleships was less accurate than that of their battle cruisers, a fact which will be demonstrated several times during the day.

At 4.52 Hipper turned his five battle cruisers in succession 180° to the left—away from the enemy—and steadied on a northerly course, continuing his action with the fifth battle squadron, which still kept on to the southward.

At 4.57, in accordance with instructions from Beatty, the fifth battle squadron turned in succession through 180° to the right and steadied on a northerly course. This squadron came under the fire of the leading ships of the battle fleet, but at such long range that probably no hits were scored.

The *Nerissa,* which with the *Moorsom* had been unable to attack the German battle cruisers and had been proceeding to the southward, now moved toward the battle cruisers which were on a northerly course. Two torpedoes were fired at a range of about 7000 yards. *Moorsom* fired four torpedoes at the second and third ships in the German battle fleet at ranges of about 8500 yards. *Nottingham* of the second light cruiser squadron fired one torpedo at the extreme range of 16,500 yards.

The first and third light cruiser squadrons, and the *Fearless* with the destroyers of the first flotilla, which had just been concentrated, took position ahead of the battle cruiser fleet. The *Champion* with the destroyers of the 13th flotilla took station near the fifth battle squadron.

As soon as the German battle cruisers turned to the northward the second scouting group of light cruisers which had been following them to the southward also countermarched and took position ahead of Hipper. They were joined here by two additional scouting groups, probably the third and fourth, which had arrived with the German battle fleet. Several flotillas of destroyers accompanied the light cruisers, while the remaining flotillas proceeded with the battle fleet. Vice Admiral Scheer took command of all the German forces.

XII. THE RUN TO THE NORTH. MOVE 8. 5 TO 5.35 P. M. POSITION 8

All the British and German forces continued to the northward. The first and third light cruiser squadrons and the destroyers of the first flotilla led the British formation. Then came the battle cruiser fleet of four ships which held the five German battle cruisers at a range of about 14,000 yards. Next came the fifth

At 5 p. m. the battle fleet was in position Latitude 57° 24′ N., Longitude 5° 12′ E. The course was 132° true and the speed 20. The scouting line of the first and second cruiser squadrons was about 16 miles in advance of the battle fleet, steering the same course and making the same speed. They were spaced at intervals of six miles on the line.

XIII. THE BRITISH MAIN BODY COMES ON THE SCENE. MOVE 9. 5.35 TO 5.55 P. M. POSITION 9

The British forces under the command of Admiral Beatty continued to the northward, gradually changing course to the eastward

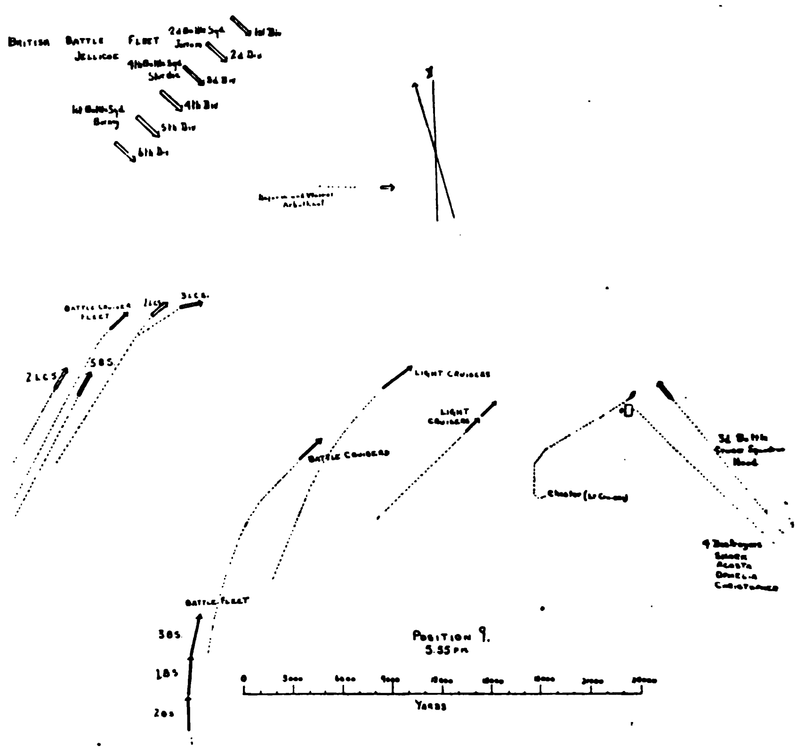


FIG. 13.

so that at 5.55 the course was about 45° true. The range from the British battle cruisers to the German battle cruisers was about 14,000 yards. At 5.40 Beatty reopened fire; this was very effective

between 5.42 and 5.52, the *Lion* firing 15 salvos. The fifth battle squadron fired at the same range at the German battle cruisers, being by this time well out of range of the German battle fleet.

The German forces conformed to the movements of the enemy in turning to the eastward, so that at 5.55 the battle cruisers were probably steering about 45° true. The German light cruiser groups were well in advance and beyond supporting distance of their battle cruisers. They were accompanied by several flotillas of destroyers.

At 5.36 the *Chester,* attached to the third battle squadron, sighted a three-stacked German light cruiser on her starboard bow, accompanied by one or two destroyers. The *Chester* changed course to west to close, but observing a destroyer in a favorable position for attacking her with torpedoes, headed north to avoid the attack, bringing the enemy cruiser abaft the port beam. The two light cruisers opened fire on each other at a range of 6000 yards. Soon two or three additional light cruisers were sighted by the *Chester* astern of the first; these vessels did not open fire immediately.

The fourth salvo of the German light cruiser hit the *Chester,* putting one gun out of commission and wounding many of the crews of two other guns. The *Chester* now altered course to the northeast to receive assistance from the British battle cruisers. As she changed course the remaining enemy vessels opened fire, inflicting serious injuries and killing or wounding a total of 81 men.

At 5.40 gunfire was seen by the third battle cruiser squadron. Admiral Hood changed course to starboard and headed to the northwest, bringing the enemy light cruisers on his port bow. At 5.55 he was steering about 325° true and opening fire on the light cruisers at a range of about 11,000 yards. The four destroyers in company with him were standing in to make a torpedo attack, led by the *Shark,* Commander Loftus Jones.

At 5.40 firing was heard ahead by the first and second cruiser squadrons. Soon afterward ships were seen emerging from the mist. Rear Admiral Heath ordered the second cruiser squadron to concentrate on the *Minotaur.* He then made the signal to engage the vessels sighted, but very fortunately they were made out to be the third battle cruiser squadron before fire was opened.

At 5.47 the *Defense,* flagship of Sir Robert Arbuthnot, with the *Warrior* in column astern of her, sighted four German light

cruisers bearing 177° true. These light cruisers evidently formed the third of the scouting groups, two of them being engaged with the third battle cruiser squadron at this time. The *Defense* changed course 34° to port and each ship fired three salvos at a German light cruiser. The shells fell short and the *Defense* then headed directly for the German ships, the *Warrior* following.

The battle fleet continued on its course of 132° true at the speed of 20 knots. A little after 5.40 a report was received from the *Black Prince,* the westernmost ship in the scouting line, that battle cruisers were in sight, bearing 166° true, distant five miles. At 5.45 the *Comus* of the fourth light cruiser squadron, which was spread three miles ahead of the battle fleet, reported that heavy gunfire could be seen bearing 166° and 188°. At 5.50 Sir Robert Arbuthnot reported ships bearing 188° true and heading 31° true. At 5.55 Admiral Jellicoe made a signal to Sir Cecil Burney, who led in the *Marlborough* the starboard wing division, asking what he could see.

XIV. ENGAGEMENTS BETWEEN THE LIGHT FORCES. MOVE 10. 5.55 TO 6.10 P. M. POSITION 10

At 5.56 Beatty sighted the leading battleships of the battle fleet (*Marlborough*) bearing 346° true, distant five miles. In order to take up a position to the eastward of the battle fleet, he immediately changed course to 76° true and proceeded at utmost speed. This decreased the range of the German battle cruisers to about 12,000 yards. The action between the opposing battle cruisers seems to have been very light at this time. The fifth battle squadron continued after the battle cruiser fleet and were fairly heavily engaged with the German battle cruisers.

When the third battle cruiser squadron opened fire at 5.55 on the German light cruisers which had been pursuing the *Chester,* they fired torpedoes and quickly turned away. At 6.10 nine torpedoes were seen approaching; the *Invincible* and *Indomitable* turned to starboard, while the *Inflexible* turned to port to avoid the torpedoes. Three of them narrowly missed the *Indomitable,* one passed under the *Invincible* and two others passed very close.

Shortly after Hood had opened fire on the first group of German light cruisers another group of four vessels came out of the mist. The four destroyers, led by Commander Loftus Jones in the *Shark,* advanced with the greatest gallantry to attack them. The light

cruisers opened an accurate fire which damaged the *Shark* and *Acasta*. The *Shark*, in turn, torpedoed a light cruiser, which was probably the *Rostock*. The British destroyers then turned back, but three more ships came out of the mist and further damaged the *Shark*, which lay helpless and surrounded by enemy light cruisers and destroyers. After having been hit repeatedly by

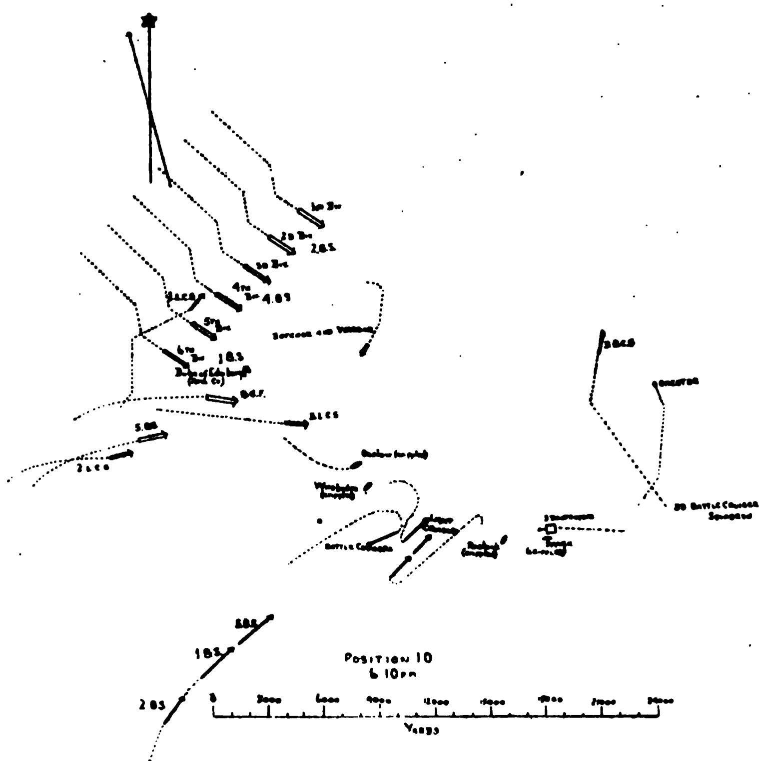


FIG. 14.

shells, two torpedoes, fired by a German destroyer, hit her and she sank with colors flying. Only six men of her heroic crew were saved. Commander Loftus Jones was killed, being awarded the Victoria Cross.

At 5.55 Sir Robert Arbuthnot was heading with the *Defense* and *Warrior* directly at the German light cruiser group, which he had sighted at the head of the German line. At 6.01 he changed course a little to the right so as to bring the German vessels on

the port bow. At 6.05 the *Defense* and *Warrior* opened fire and with their second salvos badly crippled the German light cruiser *Wiesbaden,* which hauled out of the line and lay dead in the water. The German light cruisers replied, but the range was too great for their fire to be effective. They withdrew to the southward, leaving behind the crippled *Wiesbaden.*

At 6 p. m. the British battle fleet was in Latitude 57° 11′ N., Longitude 5° 39′ E. The formation was still line of divisions, the course 132° true and the speed 20. The fourth light cruiser squadron and the submarine screen of the 4th, 11th and 12th flotillas were still in position ahead.

At about 6.01 a signal was received from Sir Cecil Burney stating that at 5.56 strange vessels were in sight bearing 144° true and steering east.

At 6.02 a signal was made to the battle fleet to change course to 166° true, division leaders changing simultaneously and the other vessels in succession after them. Speed was reduced to 18 knots to allow all vessels to get into position.

At 6.02 strange vessels were sighted by the *Iron Duke* bearing 121° true and distant about five miles. By about 6.04 these vessels were recognized as belonging to the battle cruiser fleet. This was confirmed by a signal from Sir Cecil Burney at 6.05 stating that at 6 p. m. the battle cruiser fleet had been made out distant about three or four miles. At 6.05 the following signal was received from Sir Cecil Burney in response to Admiral Jellicoe's inquiry of 5.55: " Gun flashes and heavy gunfire on the starboard bow."

At 6.06 Admiral Beatty reported to Jellicoe that the German battle cruisers bore 121° true. Jellicoe immediately changed course to 121° true.

At 6.08 the destroyer flotillas were ordered to take " Destroyer position No. 1." This was as follows:

11th flotilla. Three miles broad on the port bow of *King George V,* the leader of the left wing column.

4th flotilla. Two miles on the port beam of the second ship of the left wing column.

12th flotilla. Three miles broad on the starboard bow of the *Marlborough,* the leader of the right wing column.

The destroyers were unable to gain their positions before the deployment of the battle fleet. The disposition of two flotillas on

the left and one on the right of the battle fleet indicates that Jellicoe considered that a deployment to the left was most probable.

At 6.05 the destroyer *Onslow,* sighting a German light cruiser, probably the *Wiesbaden,* in a position favorable for a torpedo fire at the battle cruiser fleet, stood in from a position on the engaged bow of the *Lion* and engaged her with gunfire at a range of 3000 yards; the *Onslow,* sighting a German battle cruiser, closed in to attack her with torpedoes.

The British forces had effected a very heavy concentration against the head of the German line. The German battle fleet was not engaged and the five German battle cruisers and about 15 German light cruisers which led the formation were attacked simultaneously by the following overwhelming forces of the Grand Fleet:

Fifth battle squadron.................	Four battleships.
Battle cruiser fleet..................	Four battle cruisers.
Third battle cruiser squadron........	Three battle cruisers.
Defense and *Warrior*................	Two armored cruisers.
Chester, Canterbury, 3d lt. cr. sqd.....	Six light cruisers.
Shark and accompanying boats........	Four destroyers.
Onslow	One destroyer.

In the engagements between these forces which were taking place at the head of the line, all the advantages had rested with the British. They had torpedoed the *Rostock* and crippled the *Wiesbaden* by gunfire, and on their side had suffered no losses other than the sinking of the *Shark* and the heavy casualties on the *Chester.* The German light cruisers and destroyers had retired. Hipper felt compelled to do likewise. The German official report says: "British light cruisers and destroyers launched an attack against our battle cruisers, which avoided the attack by maneuvering." Hipper's maneuver, according to the sketches of Captain Schreibe, a German authority, was a countermarch to the right through 180°, bringing him on a southwesterly course and allowing him to close up the wide gap which had existed during the entire run to the northward between the German battle cruisers and their battle fleet.

XV. THE DEPLOYMENT OF THE BATTLE FLEET. MOVE 11A. 6.10 TO 6.30 P. M. POSITION 11A

The battle cruiser fleet continued on at utmost speed, steering easterly courses so as to gain a position which would place it

at the head of the battle fleet after it had deployed. Until 6.15 the course was 105° true; then it was changed to 56° true.

At 6.10 the three ships of the third battle cruiser squadron were maneuvering to avoid torpedoes fired at them by the German light cruisers. At 6.11 the *Invincible* changed course to 265° true after sighting the *Lion* in that direction. At 6.16 the *Inflexible* and *Indomitable* regained their positions astern of her. At 6.20 the German battle cruisers were sighted at a range of 8600 yards.

At 6.20 Beatty sighted the third battle cruiser squadron ahead and ordered Hood to take position ahead of him. At 6.22 Hood countermarched to the left and steadied on course 98° true, opening fire at the German battle cruisers at the short range of 8000 yards. At 6.25 Beatty altered course to 98° true and fell into column astern of Hood. The German battle cruisers were now concentrating a heavy fire on the *Invincible*, making numerous hits, none of which, however, caused serious damage.

At 6.10 Sir Robert Arbuthnot had been standing in toward the crippled *Wiesbaden* with the intention of completing her destruction. He came under the fire of the German battle cruisers, but gallantly continued on his course, passing at 6.15 ahead of the *Lion*. At 6.16 the *Defense* was hit by two salvos from the German battle cruisers and blew up. The *Warrior* was very badly damaged and passed out of the action to the westward, running astern of the fifth battle squadron. The *Duke of Edinburgh* was concentrating on the *Defense* when the battle cruiser fleet appeared ahead. She was therefore compelled to turn to port and head to the northeast. She later joined the second cruiser squadron. The *Black Prince* was seen to turn to the left at the same time the *Duke of Edinburgh* turned. It is believed that she passed to the rear of the battle fleet and in attempting to rejoin the British forces during the night was sunk by German battleships.

Rear Admiral Evan-Thomas, commanding the fifth battle squadron, had sighted the *Marlborough* at 6.06. Not seeing the other divisions, he believed that the *Marlborough* was leading the entire battle fleet and decided to take station ahead of her. At 6.19 he sighted the rest of the battle fleet and saw that it would be necessary for him to take station to the westward of it. He therefore went ships left about 90°, and then ships right 90° taking station in rear of the sixth division of the battle fleet. During these turns Evan-Thomas came under the fire of the German fleet. This fire

s generally ineffective, but one shell unfortunately struck the eering gear of the *Warspite* and jammed it so that she turned ectly toward the Germans: running directly in front of the *arrior*, she shielded that vessel from German fire. Although

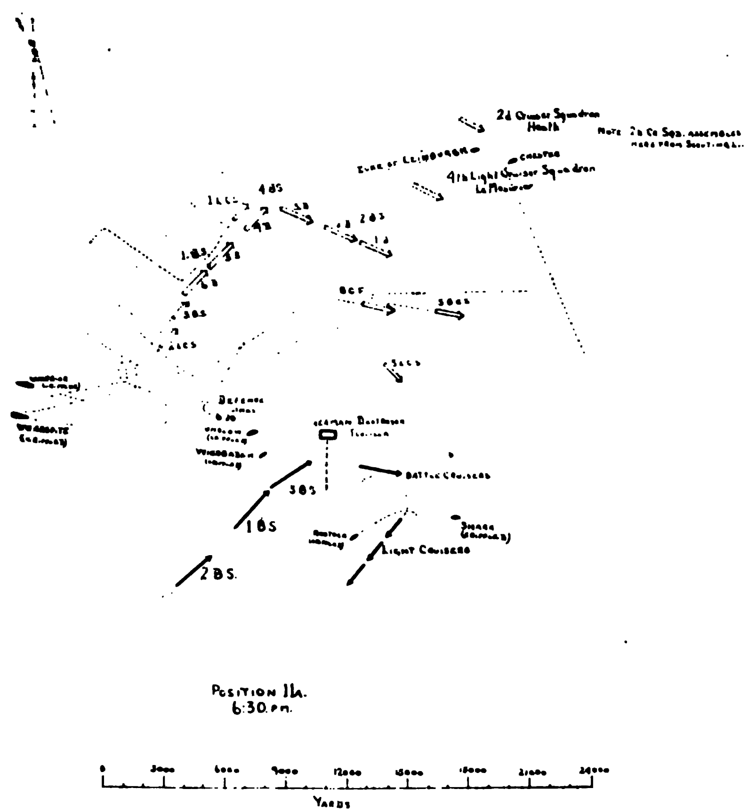


FIG. 15.

it about 30 times by heavy shells the *Warspite* was brought out f action and succeeded in gaining a British base without difficulty.
At about 6.30 the third light cruiser squadron from its position the engaged bow of the *Lion* launched a torpedo attack on the erman battle cruisers. The *Falmouth* and *Yarmouth* fired tor-edoes at a range of 7000 yards and then gallantly opened fire

with their guns on the German battleships. One torpedo probably hit the *Lutzow*.

At 6.10 the *Onslow*, Lieutenant Commander J. C. Tovey, was standing in to attack the German battle cruisers. After a favorable position was reached the order was given to fire all four torpedoes. After only one torpedo had been fired the *Onslow* was hit by a heavy shell. The captain, thinking that all torpedoes had been fired, headed away. Soon he discovered that he had three torpedoes left; he closed the *Wiesbaden* and torpedoed her; then he again headed toward the German battle cruisers and fired the remaining two torpedoes. Another hit then totally disabled the *Onslow*. The destroyer *Defender*, on the outboard side of the battle cruiser fleet was hit at about this time by a 12-inch shell and her speed was reduced to 10 knots. At 7.15 the *Defender* took the *Onslow* in tow under a heavy fire and succeeded in towing her to a British base.

Let us now consider the movements of the battle fleet. At 6.14 Beatty signalled to the *Iron Duke:* "Have sighted the enemy's battle fleet bearing south-southwest (188° true)." At 6.15 Evan-Thomas signalled that the battle fleet bore south-southeast (144° true). Sir Cecil Burney reported that at 6.07 the fifth battle squadron bore southwest (211° true). You will note that the British reported magnetic bearings. I have placed the true bearings after them in accordance with my normal procedure in this paper.

Admiral Jellicoe was therefore able to plot the position of the German battle fleet at 6.15 as 30° forward of the starboard beam of the *Iron Duke*. At the same time it was 60° forward of the starboard beam of the *Marlborough*. At 6.16 Admiral Jellicoe made signal "to form line of battle on the port wing column on a course southeast by east (110° true)." In accordance with this signal the first division changed course 11° to the east, from 121° true to 110° true. The leaders of the other five divisions changed course simultaneously from 121° true to 43° true, the other vessels following their division leaders in succession. These five divisions changed course to 110° true when they arrived in position astern of the first division. At 6.16 speed was reduced to 14 knots to enable the battle cruiser fleet to take position ahead of the first division.

At 6.14 shells commenced to fall near the ships of the sixth division. At 6.17 the *Marlborough,* having reached her course of 43° true, opened fire on the second division of the German battle fleet at a range of 13,000 yards on a bearing 20° abaft the starboard beam, 159° true. Twelve German battleships were in sight. As the other ships of the sixth division turned in succession on 43° true they also opened fire.

At 6.18 salvos commenced to straddle the fifth division, but no hits were made.

At about 6.20 a number of ships of the second and fourth battle squadrons fired salvos at the crippled *Wiesbaden.* This ship remained afloat until the next morning; only one survivor was rescued.

Now let us examine the movements of the German forces. Hipper continued his turn through 360° and after steering about northeast (true) for a time gradually turned to east (true), which course he was steering at 6.30. The German battle cruisers engaged in a fierce engagement with the third battle squadron, in which many hits were made, particularly on the two leaders, *Invincible* and *Lutzow.* At 6.10 the German light cruisers took the lead again, but by 6.30 had probably turned to the southward along the track later taken by the battle cruisers and battleships. At 6.30 German destroyers, according to the reports of *Collingwood* and *Neptune,* were visible. This was probably the third flotilla, which Captain Schreibe mentions as having made an attack about this time, The destroyers did not venture far inside the line of their battle cruisers, but fired torpedoes at long range at the battle cruiser fleet.

The German battle fleet opened fire on the sixth division about 6.14 and on the fifth division about 6.18. At about 6.20 a very heavy fire was concentrated on the *Warspite* at a range of about 8000 yards. Many hits were made on the *Warspite,* but the shooting at the British battle fleet seems poor. By 6.30 all the 16 battleships of the German battle fleet were firing. The six pre-dreadnoughts were probably a considerable distance in the rear and apparently did not take any part in the action.

While the visibility at this time had decreased it decidedly favored the British, according to the evidence of both Beatty and Jellicoe. This is probably responsible for the failure of the

German battle fleet to fire with more effect on the British first battle squadron.

By 6.30 the first three divisions of the British battle fleet were on course 110° true, the three following divisions and the fifth battle squadron were still on course 43° true, a course which increased their range to the German battle fleet.

At 6.10 the British had had a great superiority in the number of ships engaged, and the results obtained were in their favor In the next 20 minutes, however, only four additional British battleships had entered the action, while 16 German battleships had become engaged. At 6.30, therefore, the superiority lay with the Germans and the results were highly favorable to them. The forces engaged at 6.30 were:

BRITISH		GERMAN	
Battleships	8	Battleships	16
Battle cruisers	7	Battle cruisers	5
Total	15	Total	21

The losses between 6.10 and 6.30 were:

BRITISH			GERMAN	
Sunk	Crippled and sank later	Crippled	Sunk	Torpedoed
Defense.	*Warrior.*	*Warspite.*	None.	*Lutzow* (also hit by gunfire).
		Defender.		*Wiesbaden* (already crippled)
		Onslow.		

(TO BE CONCLUDED)

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

HOW OUR INFANT NAVY STRANGLED A WAR HORROR

By Edgar Stanton Maclay

During the last ten years the writer of this article has been gaged in collecting material for his "History of the United ates," and one of the items brought to light in his exhaustive earch is of peculiar interest (at this time when German ruthsness in warfare is still tingling in the minds of the civilized rld) showing, as it does, how the infant navy of the United ates strangled a serpent of military "frightfulness" at the tbreak of the American revolution. This old-time "frightlness" was worse than the gas bombs invented by the Teutons the late war, more deadly than liquid fire and quite as destruce to human life and property as the pitiless submarine campaign ugurated and carried out by the enemy in the great world nflict.

In order that we may better understand the viciousness and -reaching influence of this "war horror," so adroitly choked by our infant navy in 1775, we must remember that at that riod wood entered, almost exclusively, in all army, navy and mestic construction: so that fire became man's greatest and st dreaded enemy. In the present day of steel construction, ien danger arising from conflagration has been reduced to a nimum, it is difficult for us to realize the real terror inspired flames a century and more ago.

An illustration or two will make this clearer to us. Down to beginning of the last century, it was customary for Englishn to date current events from the "Great London Fire." It s a catastrophe that seemed to be indelibly fixed in the Angloxon mind—rivaling, if not superseding, the era of Christian ronology. Indeed, there are Britons of the old school to-day,

who find it easier to recall the date of the "London Fire" than the year in which Trafalgar was fought. An illustration, even more forceful, is had in the title of the first considerable history of the British Navy. This was a comprehensive work in six large volumes, written by Captain Isaac Schomberg, R. N., and published toward the close of the eighteenth century. It was entitled "A History of the English Navy and an Account of the Conflagration in His Majesty's War Ships and Dock Yards." Evidently this pioneer historian of England's great navy was impressed with the then prevailing idea that the demon fire was quite as formidable an antagonist to contend against as the foe in human flesh.

Just before the outbreak of the American revolution, English artisans had perfected a device (the details of which will be explained further on) by means of which the rays of the sun were collected in a system of mirrors and reflectors and could be concentrated on a given point a mile or two away (then beyond effective cannon fire) so as to instantly set fire to any wooden structure and to cause the death of any human being facing its deadly heat. It was this weapon that several of the deposed governors of the royal colonies in North America planned to use against the refractory Americans with a view to "bringing them to terms." And, right here, it should be recorded that these diabolical "town burning" machines were shipped to the new world, not at the instance of the British Government, but in spite of official disapproval—for the humiliating fact has recently been discovered that these deposed governors (too many of them being of American birth) caused these machines to be secretly shipped to the rebelling colonies.

Fire and hanging seem to have been the favorite instruments of punishment resorted to by these royal governors when endeavoring to control the spirited Americans. We had ample evidence of this during Bacon's rebellion in Virginia in 1676. When Governor Berkeley finally gained the upper hand, he hanged 20 of the leading "rebels" and burned the houses of others. "The old fool has put to death more people in that naked country than I did here for the death of my father," exclaimed Charles II. When our revolution finally broke out, we find it only natural that the Royalists turned to fire as their most effective weapon for subduing the "rebels." "We will burn their town about their ears

and see if that will bring them to reason " declared the Royalists; and we had ample evidence that they fully intended to carry out this line of " repression " when at the beginning of hostilities, Captain Mowatt (at the instance of the Tories) burned the town of Falmouth (now Portland, Maine) while Governor Dunmore, by his direct orders, caused the total destruction of Norfolk, Virginia, by fire.

TOWN-BURNING THE " WAR-HORROR " OF OUR REVOLUTION

It was by the ruthless weapon of fire that the Royalists intended to bring the refractory Americans to their knees and, had it not been for the intervention of some of the leading members of Parliament, this "campaign of frightfulness" undoubtedly would have been carried out. And, let us keep it clearly in mind that this ruthlessness was advocated, not by the influential Englishmen at home, but by the American and Canadian bred Royalists whose hatred for the patriot cause spurred them to the use of weapons which the British Admiralty refused to use on the ground that it " shocked civilization."

We know how Edmund Burke, in Parliament, took exception to the sum of £160,837 in Sir Guy Carleton's accounts expended for carrying on " of a savage war in a manner contrary to the usages of the civilized nations against the English colonies in North America "; also the sum of £16,000 for the same purpose " in the southern department of Indians "; also the sum of £5000 which " hath been expended in carrying on a war of insurgent negroes against the inhabitants of the Providence of Virginia "; and excepting " whatever hath been paid out of said extraordinary specified in General Carleton's correspondence, for one hundred crosses and five gross of scalping knives, the said expenditures being disgraceful to religion and humanity."

And the same ministerial protest was made when the deposed governors and their royalist supporters sent to England for a ship-load of these " town burning machines." We have reason to believe that the Admiralty officially refused to ship these hideous weapons; but, as we can readily understand, the unconscionable Royalists, driven to desperation by hate and reverses, found means by which a ship-load was smuggled to America—that is, the diabolical cargo nearly reached the shores of the new

world, when the ubiquitous American sailor happened along and captured the whole outfit.

Capture of the Tory "Town-Burning" Machines

It was on the 29th of November, 1775, that the little American cruiser *Lee,* Captain John Manly (afterward a distinguished officer in the United States Navy) put into Cape Ann Roads with her prize *Nancy* which she had captured only a day or so before at sea. The *Nancy* was from England, laden with military stores for the British Army, then occupying Boston. Her cargo was officially listed as follows: Two thousand muskets and bayonets besides eight thousand fuses, thirty-one tons of musket shot, three thousand round shot for 12-pounders, a 13-inch mortar, two 6-pounders, several barrels of powder and fifty carcasses or great frames for combustibles to set buildings on fire."

It was the item of "fifty carcasses" that reveals the Tory plot to carry on the war for suppressing the Americans in a manner "disgraceful to religon and humanity." Evidently the American captors of the *Nancy* did not know what these "carcasses" were or, if they did, how to use them. They seemed to regard the great frames (each one made up of four or five hundred mirrors, prisms and reflectors) as some monstrous curiosity, concocted by some ingenious Englishman for the amusement of children or for the adornment of homes. The muskets, bayonets and other military stores found in the *Nancy* were immediately forwarded to the American Army then besieging Boston, but these "carcasses" seem to have been set aside as "unknown quantities." Without doubt, the mirrors were taken apart and utilized by colonial dames as a proper household appendage, the prisms may have been used to amuse the children while the reflectors came in handy on dark nights to enhance the feeble light of tallow candles. What we positively know, however, is that the patriots did not use these "town-burning machines" for their original object.

But the British military authorities in America did know just what these diabolical machines were intended for. We have conclusive evidence of this in a letter General Howe (then commanding the British Army occupying Boston) wrote to Lord Dartmouth in England. Howe had been apprehensive, during the autumn of 1775, over the investment of Boston by the patriot

army—however much he may have affected to have despised American military prowess. When he was informed that the *Lee* had captured the *Nancy*, his apprehensions were increased for he wrote, "The circumstance is unfortunate, as it puts in the enemy's hands the means of setting the town on fire." Howe knew that the "carcasses" were aboard the *Nancy* and he had every reason to believe that the enterprising and ingenious Yankees would quickly discover their object and mechanism, plant them on hill-tops overlooking Boston and, by means of their two-mile range, be enabled to set fire to the wood-built city in spite of any cannon fire the English could bring against them. Indeed, so deadly was the concentration of sun-rays these machines could focus at a given point, that no gun crew could face their deadly heat, so each cannon would be put out of commission the instant the "sun-fire" was played on its gunners.

How Our Infant Navy Helped to Capture Boston

It is far from the purpose of this article to detract in the slightest degree the credit so justly due the American land forces in their siege and ultimate capture of Boston. Washington's masterly stroke in the occupation of Dorchester Heights and planting thereon a battery that commanded the town below is one of the most brilliant achievements in military history—the fact that its accomplishment was bloodless not in the least diminishing its glory. Nevertheless, we have it in the written official words of General Howe himself that the capture of the *Nancy* "is unfortunate, as it puts in the enemy's hands the means of setting the town on fire."

This was as far back as November, 1775, and Boston was not evacuated by the British until the 17th of the following March. During all that intervening period, Howe knew that the Americans had in their possession fifty "carcasses," any one of which, if mounted on any of the hill-tops within two miles of Boston, could have set fire to the town. That the Americans were willing to make that sacrifice is clearly revealed by Avery in Vol. V of his great history (page 306) when he records "In fact the patriots had considered the destruction of the beleagured town [Boston] and the continental congress had authorized an attack 'notwithstanding the town and property in it may be destroyed.' Hancock

wrote to Washington, 'You will notice the resolution relative to an attack on Boston. This passed after a most serious debate in a committee of the whole house, and the execution was referred to you. May God crown your attempt with success. I most heartily wish it, though individually, I may be the greatest sufferer "—the bulk of Hancock's private fortune being invested in Boston real estate.

Luckily for all concerned, and for humanity in general, the Yankee captors of the *Nancy* did not know what these "carcasses" were for or, if they did, they refused to use them for their maniacal purpose. Nevertheless, the fact remains that Howe was "apprehensive" because these machines had fallen into the hands of the patriots. He, at least, knew what they were intended for. He knew that their murderous and inflammable breath would destroy Boston within twenty-four hours, making it not only impossible for his army to remain within reach of this "sun-fire," but rendering the withdrawal hazardous in the extreme. True, the American batteries on Dorchester Heights compelled the enemy's evacuation of the city, but for months preceding that, Howe knew that the Americans possessed machines which could have set fire to the town and driven him out in disastrous haste—and to that highly appreciable, military, extent, we find that the infant navy of the United States took a direct part in determining the British commander-in-chief to evacuate this "hot-bed of rebellion" in America.

Was Washington the "Father of the Navy"?

In this connection a most interesting point rises (a point which, hitherto, seems to have entirely escaped the attention of our historians) namely: was Washington the "Father of the Navy"? We are familiar with the arguments advanced in behalf of John Paul Jones and John Barry as being "Founders of the Navy," but here the stubborn fact appears that before Jones, Barry or any other seaman received their commissions, or indeed, before Congress decided to establish a navy, Washington, as the highest military official of the rebelling colonies, issued commissions on September 2, 1775, to armed craft for the expressed purpose of capturing enemy transports and cruisers wherever found.

This was a period when the colonists were still hesitating about resorting to arms in defence of their rights. Elbridge Gerry,

about this time wrote, "We had waged a ministerial war, and not one against our most gracious sovereign." It was not until October 13, 1775, that Congress appointed its first naval committee with power limited to fitting out two cruisers to intercept British vessels laden with military supplies bound for America, and it was not until the 13th of the following December that Congress authorized the construction of the first vessels for our navy. On December 22 the naval committee submitted to Congress the first official list of officers for our navy, yet we find that as early as September 2, 1775, Washington, in his official capacity as commander-in-chief of the colonial military forces, borrowed the armed schooners *Lynch* and *Franklin* from Massachusetts and commissioned them to cruise against the enemy. He also issued commissions for other armed craft, including the *Lee* which captured the "carcass-laden" *Nancy*. The *Lynch* and *Franklin* made one of the most successful cruises of the revolution, capturing ten British vessels together with Governor Wright of New Brunswick. In all, nearly forty enemy craft were captured by the cruisers commissioned by Washington which, when we consider that they were mostly laden with military supplies (which our land forces were desperately in need of) may be considered one of the important ocean campaigns of the revolution.

No one realized better than Washington the dominating part sea power was destined to play in the coming struggle. There was not enough powder in all the colonies to carry through a single campaign; and, what was more serious, the patriots lacked the material, machinery and money with which to produce the required article. Washington clearly saw that he must rely on sea captures for arms and ammunition and it was to this end that he wrote to Governor Cooke, of Rhode Island, suggesting that an expedition be sent to Bermuda to seize the military stores known to be there. Before the Rhode Islanders could act on this suggestion, however, Pennsylvania sent two armed vessels to Hamilton and captured the stores.

Possibly Washington's appreciation of the value of sea power was enhanced by the fact that he (when in his teens) had secured a commission in the royal navy as a midshipman but had been deterred from entering the service through parental solicitude. In any event, he clearly saw that the colonists in their struggle for independence must rely mainly on sea power to secure an

adequate supply of arms and ammunition. It would seem, therefore, that in issuing commissions to the *Lynch* and ***Franklin*** on September 2, 1775 (several weeks before Congress took definite steps for the formations of a navy) Washington became not only the " father of his country " but of the navy as well.

WHAT WERE THESE " CARCASSES "?

Like many another war weapon, these " carcasses " were a growth rather than the invention of any one man. It is of historic record that Archimedes, by arranging a few mirrors in a frame so as to catch the rays of the sun and concentrate them on a given point, succeeded in burning the Roman ships that were besieging Syracuse. By using the same system of mirrors, it is known that Proclus destroyed the galleys of Vitalian when attacking Byzantium. Here were achievements sufficiently alluring to the war inventor to work on with the prospect of " wonderful " results—and the results seem to have been " wonderful " for we find that when the machine had been perfected so as to be available for sea as well as land battles, the British Admiralty firmly refused to use it on the ground that it was a " shock to civilization." These were the machines the royalist governors proposed to use in suppressing the American Revolution.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME CASEY STORIES

By Captain W. P. Cronan, U. S. Navy

Mr. Casey: "Well, Finnegan, the navy isn't what it used to be, is it?"
Finnegan: "No, sorr; and it niver was."

A writing man who once took a trip in a battleship, shipmate of mine, told me he never could write on board ship, as he was too close to events to see them with proper perspective. He had to let his impressions sink in, and think them out later at leisure. He said that he found it peculiarly difficult to get the special atmosphere of navy life. Maybe that is why officers write so few yarns; they are absorbed in their duties and have little leisure. There is no lack of material. There is a rich mine of anecdote in the navy, to be had for the digging.

So the other day, at sea, crossing the Atlantic, with time to spare, when I read Admiral Fiske's pointed remarks in the Naval Institute Proceedings, especially about thinking, I began to think on the subject of stories in general for the Proceedings, and I suddenly remembered some stories that have to do with the doings of a friend of mine named Casey, an officer of our navy. His name isn't really Casey, nor are all the names which appear herein really true, but the incidents are true, and really happened, for Casey told me so himself.

FINNEGAN

Some years ago, before the ensigns of to-day were breeched, Casey was an ensign in a small gunboat in the Caribbean, on the real Spanish Main. Even then there were wars, and rumors of wars, and a war was going on. The *M*——— made La Guaira her headquarters, and lay there watching, waiting, in company with several foreign cruisers, some English, some German, some

Italian, some French. Our whole fleet was at Culebra, and Admiral Dewey was in command of all our naval forces in the Atlantic, flying his flag at Culebra, in the fleet. There was no radio in those days, so the *M———* stayed at the other end of the cable.

On a Sunday morning, bright, hot and clear, Casey, officer of the deck, was superintending the last finishing touches before captain's inspection, held on Sunday in those days. No detail escaped him; nothing could be too neat or trim, for they were lying not four hundred yards from the Pride of the Kaiser's Navy, between whose captain and Casey's, and hence Casey, a deadly feud existed, for the aforesaid Herr Kapitän had had the temerity to greet the *M———'s* captain in rotund Hoch Deutsch on the *M———'s* quarterdeck, at which umbrage was taken and expressed in no uncertain terms, for the *M———'s* skipper was only from Pennsylvania by Harrisburg, and there are no better.

In those days many of the petty officers of our navy were old-timers; relics of the sailing ship days, which had extended to a later date with us than with other navies. Many of them were North Countrymen, Swedes, Danes, and Norwegians, but most of them were Irish, and good Americans at that. One of the latter was Finnegan, and Finnegan was a type. He could outswear, outdrink, and outfight any man aboard, and was as gentle and sympathetic as a woman, if need be.

On this particular Sunday morning, Finnegan was coxswain of the running boat, a cutter lying at the boom, which was so neat and orderly that Casey sent for Finnegan in order to compliment him, for a bit of blarney went a long way with Finnegan, and besides Casey knew there would be a " back answer " and he wanted to hear it.

So Finnegan came aft on the quarterdeck, and after saluting Casey, removed his cap, twirling it in his fingers; a man of fifty, short, thickset, with close cropped gray hair, and roving blue eyes with a merry twinkle in them. There are few such petty officers nowadays in the deck ratings. Finnegan was only a coxswain and could never be anything else; did he rise, he was broken; did he fall, he was restored, for as a coxswain, he was priceless, he was the real thing.

" An' did ye want to see me, Misther Casey? "

"Yes, Finnegan, to tell you that I'm glad to see that there's at least one coxswain in this ship that I don't have to get after about that running boat; she's all right, looks fine."

A slow smile spread furtively over Finnegan's shrewd face, for Casey was by way of making up for being "Hhar'rd" on him after he had returned from liberty in Willemstad, in the Island of Curaçao, whither they had gone for coal the week before.

"Well, Misther Casey, you know how it is, wan of thim Ger'r-man gintlemen was in char'rge of that boat lasht week, and beggin yer pardin, Misther Casey, they's only a few of *us* lift."

"Go for'ard with you, you flannel mouth," said Casey, and that was the end of it, for then the assembly sounded.

CASEY'S WATCH

It happened on the battleship cruise around the world. The fleet lay at anchor in the harbor of Callao, in Peru. Coaling was finished, and all hands were keen to see the Land of the Incas. Casey was a watch officer in the flagship, and coming off duty, decided to run up to Lima to see how the old place looked, and if it had changed since his previous visit as a midshipman. He wanted to go up the Arroya railroad to the top of the Andes, a treat he had missed before; a large party was going, and arrangements were to be completed that afternoon in Lima.

As Casey was putting on his shore-going togs, his chum and next door neighbor came in and asked if Casey would take his navy stop watch ashore and get it fixed; the crystal was broken, and the second hand was gone, for it had fallen down the ammunition trunk of its owner's turret that morning at drill; target practice was coming, and the watch was invaluable. "Sure, George," said Casey, "but the darned thing isn't worth it." "Well, don't forget it," said George; "it is the most important thing you have to do ashore; be sure to do it first."

So Casey went up to Lima, and the first thing he did was to go to a German watchmaker's shop to have the watch repaired; the watchmaker said he had no crystal to fit, nor any spare second hands of the right size; it would be necessary to send to Valparaiso and that would take a month, and the watch was no good anyway, because it wasn't made in Germany.

That disgusted Casey, so he went away, with the watch; he proceeded to the Club Union, to write some letters and to get in

touch with the party which would leave next day for the trip up the Andes.

Arrived at the club, Casey found it to be the usual South American club; like any club downstairs, but with a roulette wheel and baccarat tables upstairs. Sitting him down in the writing room, Casey removed some papers from his pocket, to consult them in settling some of the accounts of the wardroom mess, of which he was treasurer, and with the papers, he laid the broken stop watch on the table. Soon after, he saw one of his particular cronies from another ship coming into the club, and dashed over to meet him; together they proceeded to an adjoining room, where there was a grand party going on, sailor fashion, and soon Casey left to return to his papers.

On the desk he found his papers, but the watch was gone. Casey looked high and low, searched his pockets, called a servant, had him look about; no use, no watch in sight. "Hum," said Casey to himself, "George will give me the devil! The worst of it is he will say, 'I told you so!'"

Next, Casey went to the secretary of the club, and, in his best Spanish, told him of his great loss; how his watch was gone. But perhaps some servant, or maybe a member had seen it lying about, and would turn it in to the office, and if so, would the secretary have the goodness to keep it for him? The secretary was so kind, he was so sorry; he was sure it would be just as the lieutenant said; oh, yes, there was no doubt that the watch would turn up. Such things never, no never, happened in the Club Union. Was it not the greatest club in Peru? It was. Did not the Presidente himself belong? He did. So Casey left for the top of the Andes, telling the secretary he would return in two days for the watch.

In due time Casey returned, having sufficiently recovered from the sirroche resulting partly from the altitude and partly from the organization of the Order of the Llama at the aforesaid altitude, about 26,000 feet. Proceeding directly to the Club Union, he was informed by the Señor Secretary, sadly, that the watch had not been found; but, "do not be downcast, señor, I assure you that it will be found; oh, yes, truly, for the wives and children of the members will go without shoes rather than that the watch should not be found."

Casey returned aboard, and meekly confessed to George, handing him his own stop watch (both watches belonged to the ship)

and telling him that he'd get another when the ship arrived at San Francisco. George couldn't help rubbing it in, being human, and Casey was much discomfited; but soon they both forgot about it.

A few days later in the forenoon, the fleet was preparing for sea; Casey was off watch, in his room. The officer of the deck's messenger, a particularly sassy little sprat, knocked at Casey's door, stuck his red head and freckled face inside, and said, " Officer of the deck wants to see you, sir," getting even with Casey for having had to toe a seam the previous afternoon, the deck having been hot and the messenger barefoot; even if he had been trying to teach the monkey to write, it wasn't his fault if the monkey had upset the ink bottle all over the deck.

Said Casey to himself, " Well, I wonder what he wants of me," and went up to the quarterdeck, where the Officer-of-the-Deck indicated three exceedingly well dressed gentlemen who awaited Casey.

They had on the most finished of Parisian attire; with not only top hats, but violets as well; they were as well turned out as any members of the Higgy Leafy could be. They advanced as one upon Casey, they bowed as one, they were so polite that as Casey said afterward, " I wondered what in —, well, what I had done." One spoke in beautiful Castilian, which must be seen as well as heard to be appreciated, " Is it really the Señor, the Lieutenant, truly the same, who had the great misfortune to lose his watch in our club, our Club Union? "

Said Casey, hedging a bit, " It is."

" Well, Señor, we are a committee sent on board, on the part of the club; we have come from Lima, all the way, to see you very privately, if you please, in your room, if you would be so good."

Casey led them below, wondering what he had done that they didn't like. It looked serious.

Soon they arrived at his room, and, the door being closed, the spokesman said, " Señor, you have said that you lost your valuable watch in our club, is it not so, yes? "

" Yes," said Casey, " it is so."

" Well, Señor, it would not do for you to say that you had suffered such a great loss in our club; everywhere you go, on your way around the world, everyone would say, ah, you had a good time everywhere but in Peru, is it not so? "

" Maybe," said Casey, who by this time had succeeded in ringing for his very efficient boy, who knew his every mood, and needed no words to receive the idea he obtained through the half opened door.

" Ah, Señor, Peru is poor, but very proud, not rich like your great country; so it is with our club, for it too is Peru, for the Presidente, and the Vice Presidente and nearly all the members of Congress belong to it, and they all are so sad over your loss, yes, everyone is sad, one talks of nothing else in Lima, we have no watches in Peru like the valuable watch you lost, but—" and as he made a movement towards his pocket, Casey divined what was coming, and held up both hands in restraint, " Oh, Señor," said Casey, " please don't think of it, it was all my fault for losing the watch. I belong to several clubs in America, and I assure you that if I had left my watch lying around loose in any one of them, and lost it, the House Committee would say it served me right."

" Oh, no, Señor, look, see what we bring to you; and we ask forgiveness, in the fullness of our hearts." Whereat he drew forth a morocco leather case, with Casey's name on it in gilt letters; within lay a masterpiece of the watchmaker's art, with Casey's initials, anchors, chains and such engraved on its back, and well encrusted with jewels within.

Before Casey, overcome with surprise, could reply, the door opened, and in came Casey's boy, always attentive, and in this case, at least, on time. It was a hot morning, and the quart of cold champagne was consumed with gratitude by the visitors from Lima, for the road to Callao is dusty. Before they left, they embraced Casey, and even on the quarterdeck. The last words Casey heard from them were hailed from the departing boat, " Remember, when you come back to Peru again, as Admiral commanding a fleet, we shall say, where ees ze watch? "

Casey went below, slowly, musingly, to his room. There he took up the leather case, opened it, took out the watch and had a good look at it, both sides. It was really so! Returning it to the case, he knocked gently on the door of the next room, and entered. His friend George was writing at his desk, and looked up, with a cheery welcome.

" Hello, Casey, what's up? "

" George, I've been thinking about your watch, and that I ought to tell you how sorry I am."

"Oh, that's all right. I've got yours, you know," said George.

"Speaking of watches, George, what do you think of this one I got here?" and out of its case came the resplendent new watch.

George took it, looked it over, admired it and replied, "It's a beauty, but what on earth possessed you to blow yourself for that; you're a regular sailor, why don't you save your money?"

"Oh, it didn't cost me anything, George, old boy, that's what they gave me for losing *your* watch."

SAILORMEN'S MANNERS

Sailormen are children of nature. They live in a world far removed from that of the ordinary mortal, and know and observe but few of the conventions of polite society.

Tom Greene, boatswain's mate 2d class, captain of a 12-inch gun in Casey's turret, was Casey's pride and joy, for of all of the men in his division, Greene was the best.

It did Casey's heart good to watch Greene at drill, for he made no mistakes, and was a natural born leader, inspiring all the others. When he stood by the breech, loading, stripped to the waist, he looked like a young Greek god; his muscles rippled and slipped under the satiny skin like ropes, and the sails of the full rigged ship on his chest filled and swelled as if the ship were at sea in a breeze.

It was at target practice that he was at his best; silent, quick and calm, he patted each silken bag of powder almost affectionately as it whished past him, guided skilfully into place before the rammer head; from priming until after the gun was fired, he stood eagerly waiting for the next cycle to begin, and so well trained was his crew that the actual loading seemed slow, although the gun fired over two shots a minute—nearer three.

No one would be apt to call Tom Greene a coward; but there were times and places where he was nothing but an arrant coward. That was when there were any women near him. He literally knew nothing about them, because his was a man's world.

When the battleships arrived at San Diego, the hospitable citizens gave a huge barbecue in generous California style, for all the men of the fleet.

Tom went; he didn't know what a barbecue was, but when he got there he was hungry, and the barbecue was just what he had been looking for. It was a gorgeous feast, with all the fixings.

San Diego had done itself proud; the fairest daughters—and there are no fairer girls in all this world—had volunteered in crowds to act as waitresses. The barbecue was a huge success. Tom, lying on the ground, leaning up against a eucalyptus tree, was—well, he wasn't "fed up" as the Limies say, but he was full up, and, with a sigh of content, proceeded to roll a cigarette with tobacco of the Toro brand. When that was lighted, Tom was happy.

Just then one of the fairest of Eve's daughters spied Tom. There was something about Tom's looks that made her want to give him a piece of pie. So she coyly sidled up to Tom, and asked him if he would have some pie, telling him that her mother had made it, it was no baker's pie!

Tom gulped in dismay, then to her shocked surprised, he said, "Naw, Hell, I don't want no damn pie!"

Which same was the real truth. He had neither need nor room for that pie, and wished to convey the idea in the only language he knew.

The fair one departed abruptly; and knowing nothing about sailors, she proceeded to tell her woes to the lady governesses of the barbecue, who waxed very wroth, and informed the mayor about it; the more they talked about it, the more serious it appeared to them, so to appease their wrath the mayor promised to inform the admiral which he did.

After duly considering the matter, the admiral, not having been born yesterday as it were, doubtless consulted with his wife, as all good admirals do in such predicaments. At any rate, it was arranged that an apology would be tendered to the committee of lady governesses at the City Hall, in the mayor's offices, by some representative petty officers from the flagship.

Chairman of the committee from the flagship was, of course, the chief boatswain's mate, John Jennings, who, as a sailorman, was Tom Greene raised to the Nth power. There never was a better sailorman than John Jennings, nor one more afraid of skirts. Nevertheless, John Jennings turned up with his two helpers, at seven bells, as agreed upon, to apologize. All the way in to the inner harbor and the dock, they had been striving to think up something to say, but on arrival at the City Hall they had come to no decision in the matter, and were in a pitiful state of apprehension. The ladies, seated in quiet dignity, were awaiting them as

they filed into the mayor's offices more like truant schoolboys. than as the bravest and best men afloat.

Silence.

Finally Jennings stepped to the front, pulled at his grizzled forelock, twirled his cap, and studied his toes. Glistening beads stood forth on his brow. The ladies felt so sorry for him that they would have called it off then and there, but no, John Jennings had come to apologize; and apologize he would, and did.

"You see, Mum, it's like this: Tom Greene's a heluva good sailorman, but the ——— ——— ——— ain't got no manners!"

Which apology was gravely accepted as quite satisfactory.

THE TOP SERGEANT'S STORY

Casey had become the gunnery officer of a battleship, and his heart was full of joy thereat. But no greater amusement was afforded him than to listen to the morning report of Sergeant G———, who rapped on the door of the marine captain's room promptly at eight each morning, hauled aside the curtain smartly and proceeded to inform the captain, and regale Casey with the doings of the day before, the needs of the moment, and his hopes and fears for the future, in a brogue which was a mixture of treacle and brimstone.

Here is one of his tales:

"I was over, yisterday mor'r'nin, like ye towld me, sorr, to the W———, about thim baynits, and whin I got there, there was B——— (the marine captain) giving that fat sergeant of his the divil, him being three days' overtime and with the rats, and himself sthandin' there the while, pouring himself out a dhrink, the bottle in wan hand, the glass in the other, the while he was telling the sergeant to go for'rard for being a dir'rthy dhrunken swab, he did, and I niver thought there was more than one man in the marine corps mane enough to do a thrick like that, and that's Tippy ———, and he done it to me out in Guam."

The story was too good to keep, so Casey told it in the wardroom of the W———, whither he had gone to lunch, much to the discomfiture of the marine captain.

On Saturday forenoons, the detachments of marines in the ships at the Yard were paraded with the garrison; on the next Saturday, after the parade, the colonel, none other than the aforesaid Tippy ———, sent for the sergeants, dramatis personæ, saying, on their

arrival, that stories had come to his ears reflecting on their officers, originating with Sergeant G———, who was to go back to his ship and keep his flannel mouth shut, for the honor of the marine corps, *if he could!*

As for the other, there were ways of dispensing with his services as a sergeant, unless he kept sober.

Next morning, at eight, Sergeant G——— rapped smartly on the captain's door, and Casey heard the grievous plaint:

" 'Twuzn't in Guam he done it, 'twuz in Cienfoogus! "

CASEY AND THE ADMIRAL

The flagship of the Atlantic fleet lay at anchor in the harbor of San Francisco, on a pleasant afternoon, during the cruise of the fleet around the world.

Casey was officer of the deck, having come on watch at 4 p. m. A new commander-in-chief had just hoisted his flag aboard; the watch officers were on the alert, to know the methods and whims of the newcomer. During the afternoon a large party of children from a San Francisco orphan asylum had been on board, invited to see the ship through the kindly thoughtfulness of the admiral's wife. The children had gone all over the ship, into every nook and corner, and spent the afternoon most profitably. When they left the ship just after Casey took the deck, they were accompanied by the admiral's wife, and gave three cheers in childish treble for the admiral, who was then left quite alone on the quarterdeck.

For Casey, knowing full well that those who would speak with kings must wait, had retired to the port side of the quarterdeck, leaving the admiral alone to enjoy a stroll up and down the deck.

The admiral was pleased as Punch, and looked it. Like all humans, he wanted to share his joy, so he motioned to Casey to join him saying, " Officer of the deck, come over here, I wish to speak with you." Casey crossed over to the starboard side promptly, saluting the admiral as he did so.

" Well, Mr. Casey," said the admiral, " those were very bright children who were on board this afternoon, weren't they? "

" Yes, sir."

" They asked a great many questions about the ship, the guns, and the engines, didn't they? "

" Yes, sir."

" And they will go home and tell their parents all about it, won't they? "

" No, sir, I don't think so."

" Oh, you don't think so, and why don't you think so? "

" Because they're orphans, Admiral."

The admiral stroked his chin, musingly; then turned on his heel, walked aft and leaned on the rail.

Casey watched him go aft and thought to himself that he had a task indeed; a new admiral to take in hand. " And just to think, he has been president of the War College, and a delegate to the Hague Convention, and the Lord only knows how much he knows."

Slowly the admiral turned from the rail and stepped over the hatch coaming to descend to his cabin. As his head was about to disappear, he called Casey to him, and said, with a twinkle in his eye, " Mr. Casey, I don't even allow officers on my staff to talk to me like that! "

When the cruise was over, no officer in the ship had a higher opinion of the admiral than Casey, although they had several similar differences of opinion during the cruise.

Then Casey decided to go to the War College, to see if there was anything in it, and as he approached the portals of that hall of learning, who should be leaning against a pillar, to greet him, but the admiral, who slyly remarked,

" Well, well, look who's here. Well, Mr. Casey, what are you going to say to me now? "

Casey had little to say until one day when he became much perturbed over his lack of knowledge in general in respect of a particular task in strategy assigned to him, so he betook himself to his old friend, the learned admiral, whom he found in the library, for guidance.

The admiral said, " Well, Casey, so you think I do know something about this, eh? "

Casey admitted that if anyone should it would be the admiral.

" Well, I don't," said the admiral, " but the answer is there, go find it," and with a gesture he indicated the well laden shelves of the library.

" That is what you came here for, to seek, and to find, and what you find out for yourself is of the greatest value; it is all there."

And Casey, who had come to the War College to scoff, remained to pray.

the statement that hundreds of the reserve engineers left the service vowing never to return and that this attitude was provoked by the pecuniary discrimination they suffered, particularly the chief, first and second assistant engineer officers, I am making a statement which can be verified by anyone who chooses to step into any marine engineers' local headquarters. When the naval reserve was first proposed to the members of the naval auxiliary service, this condition was not extant and equal position prescribed equal pay. Why or how this proposition was later changed, I do not know, but this I do know: the majority of the good assistant engineer officers of the naval auxiliary service have since left it at the first opportunity, the remainder remain hoping that conditions will change, and probably for the same reasons as myself, that they have naval preferences due to previous service or affiliations which incline them to disregard, apparently, this discrimination.

For a first and second assistant engineer officer to receive less pay than the corresponding deck officer is, in the merchant marine, an impossibility. Actually, while second, and later first, assistant engineer, in the employ of a certain eastern steamship company less than three years ago, I received more pay than the corresponding deck officers. This was an exception and unjust, but it is a fact.

A vice-president of a certain west-coast steamship company, mentioned in "U. S. C. N.," once told the master of one of his ships that "there are but four officers absolutely required for the safe navigation of a ship: the master, chief, first and second assistant engineer officers. After getting clear of, and until within easy distance of port, the quartermaster could be trusted with the wheel to hold the course (this was in pre-war days), the master only being required for emergencies and when entering or leaving port. Furthermore, the changing of chief engineers costs us on an average $15,000, while to change masters costs no more than a new set of bedding." This is the limit of presumption, but was prompted by the fact that one of their ships was brought home safely over a distance of over a thousand miles by the chief engineer, not a deck officer being aboard.

With the proposed changes incorporated in this article, I would propose the widest distribution of it. Donate it to the largest newspaper syndicate, and to the most popular weekly journal (say the *Saturday Evening Post*) and to any others which might be induced or have sufficient interest to publish it. With or without the proposed changes, it cannot help but awaken the liveliest interest and discussion among the people at large, few of whom ever heard of the PROCEEDINGS, or would ever have the pleasure of having the facts laid before them in a more lucid or agreeable manner.

ERRATA

U. S. NAVAL INSTITUTE PROCEEDINGS NO. 200

DISCUSSION

A Few Notes on Alternating Current

By Lieut. Commander Ellery W. Stone, U. S. N. R. F.

TYPOGRAPHICAL ERROR

Page 1759, line nine, third paragraph, " 600 cycle " should read " 60 cycle."

[illegible]

of Members

CEEDINGS *are to be sent, and thus insure their receipt.* Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 15th of each month.

Book Department

The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles

The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article

is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, 155 and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for cópies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., NOVEMBER 15, 1919.

INFORMATION INDEX

PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER WALLACE L. LIND, U. S. Navy

GENERAL ARRANGEMENT

FRANCE

THE FRENCH VERSION OF THE FUTURE OF THE SUBMARINE.—It is not doubted that the submarine will survive the war. Because a disloyal enemy has acted contrary to the rights of peoples and other nations is no reason why other nations should be deprived of a means of defence already proven.

The submarine makes henceforth part of a fleet logically constituted and all the navies will join in possessing a certain number of them whether for offence, defence, or for a reserve force. It cannot alone constitute this force, but it is henceforth one of the necessary elements.

Under which form and what are, at this point of view, the teachings of the war?

This leads us to remark that the progress made by the submarine during this time when so much was being told about it has not been very great.

Its progress has been not at all comparable to that of aviation. In reality nothing hindered the construction in 1914 or even a little before of boats like the submersible cruisers of which Germany was so proud in 1918, and whose results were only of a mediocre kind. The only true innovations realized since the beginning of the war consist in the mounting of artillery and the planting of mines. Now the artillery has but little interest except for attack of unarmed merchant ships and in this respect does not merit attention, besides it is installed without great difficulty upon a submarine of medium dimensions. As to mines, their planting exacts the greatest discretion in the operation of anchoring and no other kind of vessel is so adapted to the work of planting them unknown to the enemy. It is probable that all the submarines constructed in the future will be mine-planters, and at the same time torpedo-boats like the last German U-boats and the English L-boats.

Apart from the addition of new arms, perfection of detail is seen in the most recent submarines. Is that a great progress and will this evolution continue? It is permissible to doubt it. The increase of dimensions is only a means of uniting in each unit more power, greater speed, more security. Now, the power of a submarine depends upon the torpedoes which influ-

ence but little its displacement; the embarking even of several reserve torpedoes does not require great increase of tonnage. Speed in this class of vessel costs more weight than all others and while its value is not deniable it is less great than in a cruiser or a torpedo-boat. As to safety. it is less assured in a large submarine than in a small one because the first conceals itself less easily than the second, and above all, because there is danger of a torpedo from one of like kind, the effects of which cannot be diminished by its compartments unless sizes are used which are unknown at present.

In the 300 submarines that Germany has constructed during the war there are many differences of displacement from the 200 tons of the first U. B. up to 2400 tons of submersible cruisers. Against ships of war, as well as against merchant ships, the very large submarine has shown itself less useful than the very small one. Those who have made great trouble for the Allies are the submarines of medium tonnage, the U. and the U. C. from 600 to 1200 tons. It seems that 1000 tons permits realization in a very satisfactory manner of a plan of a submarine provided with all necessary qualities and that it may be wise not to exceed this figure.

The French Navy had been the first to approach it with the *Nereides* and *Gustave Zede* and we may remark at this time that the plan of these vessels worked out in 1910 is not far from the plan which has given birth to the best English and German submarines of 1917 and 1918.

Yes, a question in the construction of motors, alas! and also the endeavor to get a too great speed with too small displacement have hindered these ships from having all the value expected of them; it is not less true that our navy, before all others, has endeavored to realize a conception which only obtained hold elsewhere much later and under the pressure of events.—*Moniteur de la Flotte*, 8/2.

PROPOSED FRENCH SCHEME FOR MAINTAINING HER NAVAL POWER.—In the July 16 number of our English contemporary *The Naval and Military Record* is found the following comment:

"In warships of all sorts England decidedly holds the lead on the list, while France finds her resources in naval construction paralyzed by the invasion and devastation of the enemy. France's opposition to the proposition of destroying the German fleet interned at Scapa Flow is well understood if one regards this sentiment in the light of the Republic's natural anxiety concerning the filling-up of the gaps made in her navy through the happenings of the war. The position of the principal navies of the world from the point of view of modern battleships, at the beginning and at the end of the war, was as follows:

"Great Britain, 33 in 1914, 35 in 1919; France, 18 and 17 respectively; Italy, 6 and 10; *United States*, 14 and 23; Japan, 4 and 9; Germany, 19 and 21; Austria, 4 and 2; Russia, 9 and 8."

The last three powers may be disregarded by us. Let us not forget (as the *Record* has done) that the surviving battleships of Austria now fly the Italian flag (see a list of them given in the *Vie Maritime* of June 10, 1919, page 6), and we shall then have the following list:

	England	U. S.	France	Italy	Japan
Modern battleships	35	23	17	10	9
Battle-cruisers	10	6	None	None	4
Old battleships	6	13	5	4	6
First-class cruisers (protected cruisers)	19	12	15	5	12
Light cruisers	90	13	3	6	8
Destroyers	390	326	96	58	?

This list, according to *Brassey* of 1919, "brings forth the satisfactory evidence that the English have every reason for self-congratulation concerning the present strength of their fleet, and should have all confidence

that for several years to come they will be able to maintain the command of that sea communication which is of so vital an importance for the existence of the Empire. In view of what has been done by the Americans, this outlook seems full of optimism.

And we French, what conclusions may we draw from this condition of affairs?

We have 17 battleships, so-called modern, but without value because they lack speed, and not a single battle-cruiser, and this after a war in which the immense strategic and tactic importance of speed has been demonstrated. Our 15 first-class cruisers are 15 old protected cruisers; the plans of the more modern of these date back to the year 1905 (fourteen years!), their speed varying, on paper, from 24 knots to 20.5 knots. With this slow speed they cannot chase the light enemy cruiser with a speed of from 27 to 30 knots nor escape from those battle-cruisers carrying 305 or 380 mm. guns! Our protected cruisers are not even equal to those of the Arbuthnot division which were annihilated in a quarter of an hour while under fire at the Jutland battle.

Our light cruisers, what of them?—the *Guichen*, the *Chateaurenaud*, and the *Jurien de la Graviere* . . . . making 23 knots on paper, 20 and even less by actual tests made from 1899 to 1901, twenty years back, alas!

What of the destroyers? There are scarcely twenty of them, counting those of the Japanese. The rest are worn to the timbers through the intensive four years of war service without a respite. Moreover, they are very lightly armed with poor little 380 and 450 cm. torpedoes and with miserable 47 and 65 mm. guns, while nowadays torpedoes everywhere measure from 50 to 60 cm. and the guns of destroyers are from 100 to 150 mm.

Our naval force is now but the shadow of its former self.

In order to raise the navy's standard we would not be able to construct a fleet of 12 speedy battleships. Costing 150 millions of francs each, the sum expended for this construction would be about three billions. And moreover where would we get the armor-plate, the workmen, the metal and the constructive materials needed for these monumental works in steel?

We should, therefore, carefully put in working condition the submarines and torpedoes we already possess. We should push to the supreme point of perfection our naval aviation force and our coast defences (movable batteries on rails and highways), purchase light warships of an extremely rapid type, and, above all, construct *submarines* and *bombing planes*, impressing upon ourselves the fact that these will never be rapid enough or perfect enough nor will their torpedoes be powerful enough . . . .

The French navy should more than ever be in the extreme advance guard of naval progress. As the material accumulates for the production of this power, we should be quick to seize with intelligence these new forces and apply them properly.

If the French navy wishes to survive it should leave the broad highway and cease to follow in the wake of England. She should regain her individuality and she must labor, seeking in her own brain for new ideas, and of each new idea make the greatest possible use.—*La Vie Maritime*, 7/25.

FRANCE'S PEACE ARMY.—From the statements which have been issued as to the reorganization of the French Army, it will be seen, as most sane people foresaw, that France has not concerned herself with the declarations of some of the leading men in this country, that conscription was to be done away with not only in England but throughout Europe. The French statesmen have throughout maintained that their country occupies a very different position than do two of the more powerful of the nations which if she is attacked are to rally to her support—the one from across the Channel, the other from over the Atlantic. France retains the principle of compulsion in the recruitment of her future army, and the only change she has made is in the strength of the levy which annually she will call to the colors. In pre-war days she called up every year 600,000 men for military training,

whereas in the future her army is to be recruited by calling up an annual class for active military service, reduced to one year on a universal compulsory basis, of 200,000 men only, and by enlistments and re-enlistments forming a regular section of the army of 150,000, the total peace strength being only 350,000 men, increased on a war footing to 1,300,000. If we add the territorial and reserve forces, we may consider these as forming a reserve of some two million, and it cannot be said that this provides an excessive force for a nation which may have for ever to stand on the outposts in face of an enemy which is momentarily crushed, but which, having been left her cadres, may find small difficulty, given the opportune moment, in re-constituting her army.—*The Army and Navy Gazette, 9/27.*

THE LOSS OF THE FRENCH TORPEDO-BOAT "325."—On the 22d of January, 1919, the torpedo-boat *325* commanded by Lieut. Commander Senac proceeded to the clearing of mines designated by the German authorities in virtue of the armistice and planted in the north channel of the Kerkenna Islands. These mines had not been previously marked.

Suddenly the captain and the captain of the watch perceived at the same time a mine submerged at a depth of 5 feet and distant only about 3 feet from the hull. The signal was given to back astern, but the *325*, pushed forward by the wind and sea, passed over the mine which, probably hit by the hull or screw, exploded about five or six seconds after being seen.

The explosion was formidable. The after part of the torpedo-boat was entirely destroyed and disappeared immediately, while the forward part at an angle of 45° sank soon afterwards, dragging with it 18 unfortunates imprisoned in the forward part.

The small boats of the other torpedo-boats, present at the place, rescued only eight survivors, among whom was the commanding officer who had been thrown into the sea with the rest of his crew.

In a hearing on July 25, the War Council of Toulon investigated the responsibility of the commander of the *325* with regard to this sad occurrence. Finding that no criticism could be made against Lieut. Commander Senac, the Council acquitted him unanimously.—*Moniteur de la Flotte*, 8/2.

THE FRENCH NAVY IN THE MEDITERRANEAN.—A ministerial decision of June 25 fixed the organization of our naval forces in the Mediterranean. It is stated that this organization is "provisional,"—that is to say, to continue until Parliament or public opinion imposes modifications on this organization.

We will have in the Mediterranean:

1. A vice-admiral C-in-C (Vice-Admiral de Bon) having a force of unclassified vessels, *Provence* and *Jurien de la Graviere*.

2. A vice-admiral (Vice-Admiral Charlier) commanding the 1st Squadron, composed of the battleships *Courbet, Jean-Bart, France, Paris, Lorraine* and *Bretagne*, with a rear-admiral, second in command (Rear-Admiral Violette).

3. A 2d Squadron composed as follows:

A rear-admiral (de Marguerye) division of battleships,—*Voltaire, Condorcet, Diderot.*

A rear-admiral (Lejay) division of cruisers,—*Jules-Michelet, Waldeck-Rousseau, Ernest-Renan.*

4. Four divisions of destroyers of six units each,—two with full and two with reserve complement.

5. Two mine layers, one of which is armed, for the Black Sea.

6. The sloops *Antares, Alyol, Altair;* the "avisos" *Escaut, Scarpe, Suippe* and *Yser;* the "cannonieres" *Tapageuse, Courageuse,* and *Agile.*

7. The mine sweepers *Gres, Marbre, Rateau,* and *Coquelicot,* with four sub-chasers, destined for the operations in the Black Sea.

8. A rear-admiral (Mornet) commands the Division of Syria, at Port Said, comprising the yacht *Phenix*, the cruiser *Cassard*, 3 cannonieres and 2 mine sweepers.

9. A rear-admiral (Excelmans) commands the Division of Naval Bases of the East, comprising a villa on the Bosphorus, serving as quarters of the admiral and his staff, the yacht *Luciole*, a hulk, the *Tourville*, at Constantinople, the tanker *Shamrock* at Salonica, and a half dozen service vessels.

10. A flotilla of the Danube,—6 cannonieres and 10 vedettes.

11. A train, comprising one oiler and one repair ship.

12. Four ships (one the *Guichen*) for the line of supply.

13. A rear-admiral (Ratye) at Venice, for the surveillance of affairs on the Dalmatian coast. His yacht, the *Atmah*, has just been disarmed.

We have, then, exercising the command of the Mediterranean, two vice-admirals and six rear-admirals, without counting the staffs of the ports and navy yards. This number is just one vice-admiral less than during the war.—*La Vie Maritime et Fluviale*, 7/25.

GREAT BRITAIN

RETRENCHMENT IN FULL SWING.—The process of reducing the navy and of all expenditure in connection therewith is being carried out with a rapidity and a ruthlessness which should gladden the heart of the most zealous economist. Many more ships, including several which are of modern design and quite efficient in every way, have lately been added to the disposal list; while scores of others have been, or shortly will be, paid off and reduced to "care and maintenance" status. The Home Fleet is to be brought down to reserve complements, leaving the Atlantic Fleet the only fully manned force in home waters. At the same time, wholesale discharges of employees at all the Royal Dockyards are taking place, and although thousands of notices were temporarily suspended on account of the railway strike, they are expected to take effect now that the dispute is settled. The Admiralty has just issued to the Dockyards instructions that for the time being no work except such as has been finally authorized is to be proceeded with unless direct approval is forthcoming from Whitehall in regard to the estimated cost in each case, viz.:—(*a*) Alterations and additions to ships and vessels, yard craft and fleet auxiliaries, whether approved in fleet orders or otherwise; (*b*) alterations and additions to shore establishments, *e.g.*, dockyards, barracks, colleges, etc.; (*c*) new mooring schemes, modifications to mooring schemes, shifting and relaying moorings, purchase of new carts, wagons or other plant, purchase of new machinery, installation of telephones, electric light, or modifications to existing installations; (*d*) no new experiments are to be undertaken without prior approval of the estimate of the cost that may be involved, and no extension of existing experiments beyond the present authorized expenditure is to be undertaken without similar prior approval.—*The Engineer*, 10/10.

NEW PROTECTED LIGHT CRUISER.—Recently there was launched at Messrs. Beardmore's Dalmuir Yard, the name-ship of the *Raleigh* class of protected light cruiser.

Designs for these vessels, which are much heavier than the earlier classes of light cruisers, were prepared during 1915. Intended for ocean work in any part of the world, they are 565 feet long, with a beam of 65 feet, a draught of 17.3 feet, and a displacement of 9750 tons. Originally it had been intended to equip these vessels with machinery developing 60,000 h.p.; but subsequently it was decided to increase the power to 70,000 h.p., considerable modifications being thereby entailed.

Twelve Yarrow-type boilers, working at a pressure of 235 pounds per square inch, are arranged in fours in three boiler rooms. Eight of these boilers, which are in the two forward rooms and of a larger size than those in the after room, are fitted for burning oil fuel only. The four smaller boilers are arranged to use both oil and coal.

The four sets of geared turbines (also constructed by Messrs. Beardsmore) are of the Brown-Curtis type, having four shafts, each of which is driven by a high-pressure and a low-pressure turbine. A cruising-turbine is directly connected to the forward-end of each high-pressure turbine, and is provided with a suitable disconnecting gear. The reduction gearing is arranged in the usual manner, *i. e.*, the high- and low-pressure turbines are placed on opposite sides of the center line of the propeller shafting, and the pinions of each turbine gear with a single wheel bolted on the shaft; the gearing is of the double helical type. Each shaft is fitted with a Michell thrust bearing, supplied with forced lubrication and mounted immediately aft of the gear-box.

The ship is constructed with the large flare necessary to keep the decks dry when running at high speeds in rough weather, and the modified form of "bulge" used for protection against under-water attack.—*The Technical Review*, 10/14.

SUBMERSIBLE BATTLE CRUISERS SAID TO BE FAVORED BY BEATTY.—The political correspondent of the *Evening News* says there probably will be a great change in Great Britain's naval policy with the advent of Vice-Admiral Sir David Beatty as First Sea Lord in succession to Vice-Admiral Sir Rosslyn Wemyss, who resigned last week.

Vice-Admiral Beatty's friends, says the correspondent, declare that he believes the future warship will be an oil-driven submersible battle cruiser, and that the Admiralty's plans may be shaped in accordance with this belief. The dreadnought will not be altogether eliminated, but it will be considered of secondary importance.—*New York Times*, 10/14.

A PACIFIC BASE.—Lord Jellicoe, in a speech at a reception given him in the Fiji Islands, is reported to have suggested the probability of Suva being used as a naval base by the British warships in the Pacific. The suggestion is interesting, and may well lead to a discussion of the merits of this place in comparison with those of Herbertshohe, the former capital of German New Guinea, which has also been mentioned in this connection. Herbertshohe, captured by an Australian Naval Brigade under Commander J. A. H. Beresford, R. A. N., on September 11, 1914, was the seat of government not only for New Pommern Island, on which it stands, but also for Kaiser Wilhelm's Land, the Bismarck Archipelago, and the Caroline and Marshall Islands, thus indicating that our late enemies must have considered it favorably situated. For the last fifteen years there has been no important British naval base in the Pacific. Singapore was regarded as a rallying place for the three divisions of the Eastern Fleet once a year, but the world situation is now greatly changed, not only by the war but also by the opening of the Panama Canal. Our force on the North and South American stations is as much a Pacific as an Atlantic one, as was indicated by the new boundaries of the foreign stations recently issued. At present, the Fiji Islands come within the limits of the New Zealand station, whereas Herbertshohe or whatever new name is given to it, is included in that assigned to the Royal Australian Navy.—*The Army and Navy Gazette*, 10/18.

WARSHIPS FOR "DRUMMERS."—*England Will Let Them Book for Sailing to Foreign Lands.*—(Associated Press.)—British commercial travelers and the representatives of business houses are to be permitted to take passage aboard every British warship leaving the country for abroad.

This, according to Sir Hamar Greenwood, Under Secretary for Home Affairs, who made the announcement to-day before the Association of British Chambers of Commerce, is "a move unique in the history of the empire."

Sir Hamar said that Walter Hume Long, First Lord of the Admiralty, had given his assent to this special service.—*N. Y. Times*. 10/30.

STRENGTH OF NAVAL PERSONNEL.—The report that the personnel of the navy is to be brought down to 100,000 officers and men is probably well founded. This is not so large a reduction as might at first appear. It is true that the active personnel voted for the financial year 1914-15, or just before the outbreak of war, was 151,000, but this figure was nominal and never actually reached. The numbers actually borne on January 1, 1914, were 144,871, so that the reduction which now appears to be contemplated is equivalent to something over 30 per cent in the pre-war peace strength. Remembering that in 1914 we were faced across the North Sea with a German Navy for which over 73,000 men had been voted, and that this conscript force has been swept away under the peace terms and replaced by a voluntary, long-service personnel which must not exceed a strength of 15,000, it will be seen that 100,000 officers and men on the active list ought to be ample in the present situation. The maximum reached during the war by the mobilization of the various reserves was 450,000, and in the ease with which the total is now being reduced to 100,000 we see again the great wisdom of the policy which created the Royal Naval Reserve, Royal Fleet Reserve and Royal Naval Volunteer Reserve, all of which could be and were considerably expanded during the war by men engaged for temporary service, without affecting the position of the regular *cadre* of our long-service seamen.—*The Army and Navy Gazette*, 10/18.

AUSTRALIAN NAVAL PROGRAM AS ADMIRAL JELLICOE PLANS IT.—Admiral Viscount Jellicoe, whose mission in Australia was the reorganization of the Australian Navy, has completed his report. This provides for the establishment of an Australian naval unit composed of eight modern battle cruisers, twelve light cruisers, twenty-four destroyers, and twelve submarines and supply ships. This program is to be completed in 1923 at a cost of £5,000,000 annually.

It is considered doubtful whether the government will accept these proposals.—*N. Y. Times*, 9/12.

TO DISARM CANADIAN VESSELS.—According to an announcement of the Canadian Department of Marine and Fisheries, it has been decided that the retention of armament on ships of Canadian register will be discontinued forthwith.

Shipowners are advised that the retention of armament on defensively armed merchant ships of Canadian register has been under consideration of the Department of the Naval Service, and that it is considered that guns need not remain on any ships.

With regard to fittings which were necessary, the following is the policy of the Admiralty with regard to British registered ships: "On removing the guns, the gun seating is to remain in ships over 3000 tons gross register, and stiffening to remain in all cases, except in vessels under 1600 tons, where, in the opinion of the naval authorities, it materially affects cargo or passenger accommodation. The stiffening for howitzers may also be removed in all ships if it interferes with cargo or passenger accommodation."

A similar policy for Canadian registered ships is recommended, and it is requested that the Department of the Naval Service be advised as to what action shipowners propose to take in the matter.—*Shipping*, 9/27.

FLOAT 19 SHIPS AT SCAPA FLOW.—Acting Secretary of State Phillips to-day received a dispatch from London stating that as a result of the efforts to raise the German vessels scuttled at Scapa Flow, the battleship *Baden*, the cruisers *Frankfort*, *Nuremberg*, and *Emden*, and fifteen destroyers have been floated and three other destroyers probably will be raised.—*N. Y. Times*, 9/16.

POST-WAR NAVAL POLICY.—When the House of Commons reassembles it is probable that a great majority of the members will return from

their constituencies pledged to support a vigorous policy of retrenchment in national expenditure. The need for strict economy is plain to every eye, and while we do not share the gloomy view that insolvency is only a question of time, we agree that unless the present inordinate drain on our resources is promptly checked we shall find ourselves sailing perilously near the reef of financial disaster. The leaks are many, and every one has his pet theory as to how they may best be stopped. But if precedent goes for anything, the House of Commons will first return its attention to the combatant forces of the State.

When the budgets for the navy, the army, and the air force were promulgated for the current year, astonishment was general at the huge sums demanded on behalf of each of these establishments. As the Peace Treaty had still to be signed, and the military situation in Europe remained obscure, the various estimates were provisionally accepted, though not without demur. Since then the Treaty has been signed, the strength of our Rhine army has been fixed at a single brigade instead of several divisions, and a decision has been reached to withdraw our forces from Russia. Our military commitments have therefore undergone a substantial reduction, and there is reason to hope that the outlay on the army and the air force will in consequence be less heavy than was anticipated at the beginning of the year. For the moment, however, we are principally concerned with the Navy Estimates, which are certain to encounter opposition when they are presented in detail next October or November. The circumstances which have made possible a reduction in the land and aerial armaments should react still more favorably on our naval forces. The German Navy has practically disappeared, since under the Peace Treaty that country forfeits the last of her dreadnoughts, and is left with a mere coast defence fleet comprising a handful of small vessels of obsolete design. As Russia is not in the least likely to enter the lists as a first-class sea power within the calculable future, we are now freed from all embarrassments in northern waters; while the obvious disinclination of both France and Italy to spend money on large naval programs removes the last vestige of doubt as to the stability of our maritime position in Europe. Nor for many years is that position likely to be affected in other quarters of the world by the naval activity of the United States and Japan, which alone among the powers are continuing to build capital ships. In brief, our supremacy in every class of fighting tonnage is so great that no serious risk would be incurred if we suspended construction altogether for a few years. That being so, the Admiralty, we fear, will find it difficult to explain to Parliament why it determined to complete eighty-four of the warships which were in hand when hostilities ended. Some of these eighty-four vessels were so well advanced that it may have been deemed more economical to complete them; others, however, had been on the stocks only a few weeks, and had they been abandoned there and then the loss involved would have been comparatively trivial. If it were desirable to continue naval building at all, we should have preferred to see a second battle-cruiser of the *Hood* class completed instead of the swarm of destroyers and submarines which have admittedly become superfluous. In his speech on the Estimates the First Lord declared that his professional advisers yielded to none in their resolution to effect economies in every possible way. We accept that statement without hesitation, but it does not follow that the House of Commons and the Admiralty will see eye to eye when it comes to formulating our future standard of strength. According to the Admiralty's new scheme of fleet distribution, the fully commissioned force in home waters is to contain ten battleships and five battle-cruisers, with a Home Fleet manned on the nucleus crew principle of six battleships. In the Mediterranean it is proposed to station six fully manned battleships. To these fleets will be attached strong squadrons of cruisers and flotillas of destroyers and submarines. Furthermore, each of the foreign stations is to have a contingent of modern light cruisers. If this program is adhered to, the

future strength of the navy in commissioned units will be twenty-seven capital ships, forty-one light cruisers, and a large number of torpedo craft, irrespective of the Royal Australian Navy. This would be a respectable force even if our interests were menaced by a first-class power; but as, happily, there is no such menace in sight, protests against the maintenance of so many commissioned ships are certain to be heard from many quarters—not necessarily only those in which an adequate navy is always opposed on principle.

Our object in directing attention to the foregoing considerations is not to urge a policy of indiscriminate retrenchment in regard to the navy, but rather to warn the Admiralty of the vulnerable points in the case which it will have to defend against over-zealous economists. If once the suspicion gets abroad that the Admiralty is spending more money than the necessities of the situation warrant, there will be grave danger of a reversion to the niggardly policy which came into effect after the Napoleonic and Crimean wars—to go back no further—when the navy was positively starved, and allowed to decline, both in strength and efficiency, below the minimum compatible with bare safety. It is because we should be the first to deplore such a repetition of ancient mistakes that we venture to express the hope that our naval advisers will see fit to modify their present program in regard to matériel and fleet distribution before it is submitted to Parliament. In ordinary circumstances we should rejoice at the worthy manner in which it is proposed to display the flag in every part of the navigable globe, not from motives of chauvinism, but because we recognize the commercial and political benefits that flow from such a policy. But the present circumstances are extraordinary, and we doubt whether the country is in either the position or the mood to sanction the disbursement of a penny for which no direct return can be guaranteed. In respect of matériel, there are methods by which the efficiency of the fleet can be not only maintained, but increased without the heavy outlay entailed by new construction. The lines of technical development are clearly indicated by war experience. The possibilities of long-range gunnery have not yet been fully explored, neither has there been time to assimilate the lessons we have learned in regard to the best system of protection against gunfire and submarine attack. Ordnance experts tell us that if the guns in our ships had been able to fire at an elevation of 25 or 30 degrees, instead of at only 15 degrees, we should on several occasions have inflicted more damage on the enemy. It is known, too, that Germany secured excellent results with her elongated shells and with the reliable fuse fitted to her armor-piercing projectiles. Moreover, she possessed a marked advantage by reason of the superior mechanical efficiency of her torpedoes and mines. It is careful attention to these technical minutiæ that prepare the ground for decisive results in war, and research work of this kind is not so expensive as new construction.—*The Engineer*, 9/5.

THE PRICE OF ADMIRALTY.—The return of navy losses during the war, which at the request of Colonel Burgoyne has been issued as a Parliamentary paper, is a most useful document in more ways than one. Its figures in regard to the casualties among British war vessels, of which 1069 were lost altogether, bring home to the country how fierce and widespread were the efforts of the enemy to wrest from us the command of the seas. Its details of the various losses give authentic information at last in regard to events which were kept secret while the war was in progress. But, to the naval officer and student, perhaps the most valuable feature in the return is the analysis of the cause of loss, both of warships and auxiliary craft, from which it may be seen what proportion of damage was inflicted on our naval material by submarine, mine and other agency. If there is a fault to be found with this analysis, it is that it might have been a little more detailed. Under the classification of "action" there are to be found such incidents as the night attack by a torpedo-boat which destroyed the

ment of the conquest of the air must have its effect upon the material of sea warfare, and complementary development and progress must follow in the latter if what we have been accustomed to call the command of the sea is still to be preserved.

We have arrived, then, at an era of experiment which should progress hand in hand with our era of economy, and thus the reductions of which Lord Beatty spoke must not only be carried out in an equitable spirit but with an unprejudiced mind. The navy, for instance, has been drastically cut down, as any one can discover who compares the number of capital ships in full commission to-day with the number in 1914. Over 150 destroyers and torpedo-boats have been sold or scrapped, and this week the placing of 52 submarines on the sale list is announced. And there is still more to be done in this direction. But there has been no such reduction in the numbers employed in the civil departments of the Admiralty. The personnel at Whitehall increased sixfold during the war, from something over 1500 to over 9000, which was perhaps natural and inevitable, but here in September, 1919, it is officially announced that *three months hence* the total will have been reduced, not to pre-war strength or anything like it, but by 1000, with a further reduction of 2000 by *next March*, when there will still be 5000 employed or three times as many as in 1914. The Admiralty personnel in 1914 occupied 12 pages of the *Navy List;* it still occupies 27 pages. Some of the new departments could surely be dispensed with altogether; all could certainly be reduced; in some there is not a single naval officer employed. Such letters and articles as Lord Fisher has published have an enormous value in this connection. Emphasizing his doctrine that economy is the soul of efficiency, and that every penny not spent on an efficient fighting ship and man is a penny taken from the day of battle, he tells, in his inimitable way, of chairs and blankets in store at the dockyards, which could not fight, but required fighting men to look after them. Then there was a paraphernalia of clerks and auditors looking after these, and then a Board of Works to look after them, and pensions for all—besides houses to house the pension distributors. Let Mr. Long get to work vigorously among such parasitic growths on shore which absorb money voted for the navy. This is a far more fruitful field for economy than still further reductions in the seagoing squadrons, in which gunnery training and general efficiency must be maintained.—*The Army and Navy Gazette, 9/27.*

"LUSITANIA" MAY BE RAISED.—The possibility of raising the *Lusitania* is now under discussion, and active steps in this direction may be undertaken if the opinion of salvage experts who have been invited to study the problem is as favorable as there is reason to anticipate. The *Lusitania* lies at a considerable depth off the Irish coast, and has been submerged for four and a half years. Her huge size would complicate the salvage operations, but it is believed that she could be lifted and moved into shallow water by the aid of flexible pontoons, which, when inflated with air. develoo a buoyancy one hundred times greater than their own weight. Expert opinion is inclined to view the raising of the *Lusitania* as a practicable proposition if the financial outlay is deemed worth while.—*Shipping,* 10/29.

JAPAN

BIG CRUISERS FOR JAPAN.—According to Japanese newspapers, the government has decided to build two battle cruisers and twenty-two other warships commencing the next fiscal year and the estimates for these ships will be submitted to the next session of the Diet for approval. The battle cruisers will be the 40,000-ton class and their cost of construction is estimated at 120,000,000 yen (about $60,000,000). In addition, there will be three light cruisers, six destroyers, twelve submarines and three river gunboats.

The disbursement is to be spread over three years from the next fiscal year. The building of two 40,000-ton battle cruisers is for the purpose of completing the "eight-and-eight" squadron which has been decided upon by Japan as necessary for the defence of the country.—*N. Y. Times*, 10/16.

AEROPLANES, JAPANESE NAVY.—Information has been received that there are about 20 planes at the Yokosuka Naval Station, all but one in bad repair. There are now building three aeroplane engines at that station. Some of the mechanics belonging to the French mission have been retained for an other year. It is said that German mechanics will be brought over.

Mitsui is rumored to own the Standard Airplane Plant at Elizabeth, N. J., which they plan to move to Japan. This firm also has a plant at Plainfield, N. J., and tried to buy the Wright-Martin plant at New Brunswick, N. J. Representatives of this firm are now in Berlin studying airplane construction.

Mogi & Company also have men there for that purpose, and are contemplating starting a factory in Japan.

LARGEST MOTOR FACTORY IN JAPAN.—The Arsenal which has been in course of construction at Chikusa, a suburb of Nagoya, is now partially completed, and the motor factories previously established at the Tokyo and Atsuta Arsenals are to be removed to this new location, where motors for aeroplanes and army automobiles are to be made. The authorities in charge expect to begin the manufacture of motors by the end of this year, although the construction of the Arsenal buildings will not be finished until March, 1923. When completed this plant will be the biggest motor factory in Japan.—*Mainichi Shimbun, a Japanese newspaper*, 8/26.

THE IMPERIAL POWDER COMPANY.—This company, which is being promoted by Mr. Eppei Miura, M. P. for Aichi Prefecture, has decided upon Taketoyo as the place for its factory. Ground covering 400,000 tsubo (326.77 acres) near Rokkozan Hill in Taketoyo has been selected for purchase, some of the land owners having already concluded agreements to sell.

The company is capitalized at M10,000,000 ($4,985,000) divided into 200,000 shares, only 15,000 of which will be open for public subscription, the remainder having been taken up by interests connected with the Tokyo Gas Company.

The company will make dynamite for use in mining, fishing, and public works, and also smokeless powder for military use, provided this is sanctioned by the War Department. However, besides making dynamite and powder, the company will manufacture chemicals and dye-stuffs for industrial use.—*Nagoya Shimbun*, 8/13.

THE NAVY FUEL OIL INVESTIGATION.—Our navy is at present using a mixture of crude petroleum and coal. Comparing the use of coal with the use of petroleum, firstly petroleum does not take up as much space as does coal, secondly it is rather cheap in price, and thirdly it produces three times as great a horsepower. Though the use of crude petroleum is necessary for us, we feel uneasy to see the declining tendency of the yearly oil production in Japan. The oil field has an unknown capacity at present, but our Navy Department will continue the work until 1920, continuing work which was begun in 1918 and 1919 budgets, by using the established amount of yen 30,468. If the trial digging is successful, it is said that we shall have no worry on the fuel question.—*Hochi, a Japanese newspaper*, 7/18.

INCREASE OF PETROLEUM IMPORTS.—Recently, in opposition to the decrease of our domestic petroleum production, the importation from America and the South Seas has increased. At present the Yokohama Standard Oil Branch has imported 500,000 gallons of oil at Yokohama by its oil tanker

Tamaru. The petroleum kept in the Yokohama bonded warehouse has reached 599,796 gallons (September, 1919).

Until last year six-tenths of the oil used in Japan was of domestic production while four-tenths was imported. The position is now reversed and only four-tenths of the oil consumed is domestic.

About nine-tenths of all imported petroleum comes from the United States and one-tenth from the islands of Java and Sumatra. The oil from the South Sea Islands is imported by the Rising Sun Oil Company of Japan.—*Osaki Asahi, a Japanese newspaper*, 9/30.

LARGE ORDERS FOR METALS PLACED WITH AMERICAN FIRMS.—Sixty thousand tons heavy steel plate, widths to 110 inches, ½ inch-1¾ inches thick, have been ordered from United States firms such as United States Steel, Inland Steel Corporation, Otis Steel Company, Jones & Loughlin, Bethlehem Steel Company. Mitsubishi has ordered 20,000 tons of heavy plate, suitable for battleships. Asano the same amount of structural and steel plate (commercial use). Prices are above market price and specify immediate delivery. Mogi & Company have ordered 12,800 tons of heavy plate (battleship weight) under like conditions.

Mogi & Company have ordered 20,000 cases tin plate and 1000 tons steel bars at any price if promptly delivered.

Two thousand tons steel bars have been ordered by Itoh & Company, Osaka.

Two thousand tons black sheets (dynamo purposes) have also been ordered by Itoh, at $10.00 per ton above market price.

THE SHANTUNG QUESTION, "DEMAND OR ENTREATY?"—The American request for another declaration regarding the return of Shantung to China is either an entreaty to Japan or an interference and coercion. If the Japanese authorities act wrongly the impression will be created that Japan's diplomacy is at the beck and call of America, and the Chinese will have greater contempt for this country. If President Wilson's request is due simply to a desire to overcome the opposition of the Republicans, it is an entreaty, but if the request is based on the plea that the assurances so far made by Japan are insufficient, it is an interference with Japan's rights and an oppression on her.

So far as is compatible with Japan's prestige and rights, we may entertain President Wilson's entreaty, if such is his request, with a view to helping him to extricate himself from a difficult position, but we should never allow our prestige to be damaged.—*Osaka Mainichi*, 9/10.

THE NAVY GRAND MANEUVERS.—Our Grand Navy maneuvers which were held from the middle to the end of October of this year, under the resident General of His Majesty, the Field Marshal Commander-in-Chief was the first maneuver in Japan since the European War. The scope of the maneuvers extended from the main island of Japan to the South Seas.

The squadrons participating were as follows:

(a) Combined Squadron under Admiral Yamashita.

(b) Training Squadron under Vice-Admiral Nakano.

(c) Second Despatch Squadron under Vice-Admiral Hidaka.

(d) All other squadrons which belong to Yokosuka, Kure, Maizuru, Bagoon, Ominato, Ryojun and Chinkai.

—*Yorozu, a Japanese newspaper*.

BLAST ON JAPANESE WARSHIP KILLS 14.—The maneuvers of the entire Japanese Navy, in which the Emperor participated, were marred by an explosion to-day on the battleship *Hyuga* in Tokio Bay. Fourteen men were killed and thirty injured. The Emperor was aboard the battleship *Settsu*.

The maneuvers, which were the most elaborate in the history of the navy, included mimic battles and airplane attacks on coastal cities.—*N. Y. Times*, 10/31.

GRADUATES FROM NAVAL SCHOOLS.—On 9th October 118 naval cadets were graduated from the Naval Academy at Etajima upon completing the three-year course. They go to sea in a Practice Squadron—as midshipmen—for about seven months, being promoted at the end of that time to sub-lieutenant.

On the 11th October 48 naval cadets (Engineering) were graduated from a three-year course in Engineering at Yokosuka Engineering College. They, too, will go to a practice squadron and will get the same promotion.

The ages of entrance for the Naval Academy is 16 to 19. For Yokosuka Engineering School it is 16 to 20. The course at Yokosuka is three years and four months. At Naval Academy it is three years.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, AS REPORTED OCTOBER 31, 1919

Type, number and name	Contractor	Per cent of completion			
		Nov. 1, 1919		Oct. 1, 1919	
		Total	On ship	Total	On ship
Battleships					
43 Tennessee	New York Navy Yard	91.2	87.2	87.9	83.4
44 California	Mare Island Navy Yard	80.3	72.9	76.5	68.6
45 Colorado	New York S. B. Co.	34.9	18.1	32.5	13.2
46 Maryland	Newport News S. B. & D. D. Co.	56.	49.3	54.3	46.5
47 Washington	New York S. B. Co.	34.4	17.2	31.2	11.8
48 West Virginia	Newport News S. B. & D. D. Co.	26.3	2.6	26.3	2.5
49 South Dakota	New York Navy Yard	Material being ordered.			
50 Indiana	New York Navy Yard				
51 Montana	Mare Island Navy Yard				
52 North Carolina	Norfolk Navy Yard				
53 Iowa	Newport News S. B. & D. D. Co.				
54 Massachusetts	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Beth. S. B. Co. (Fore River)	Preliminary plans completed and furnished to builders. Work on detailed plans resumed.			
2 Constellation	Newport News S. B. & D. D. Co.				
3 Saratoga	New York S. B. Co.				
4 Ranger	Newport News S. B. & D. D. Co.				
5 Constitution	Phila. Navy Yard				
6 United States	Phila. Navy Yard				
Scout Cruisers					
4	Todd D. D. & Const. Co.	*32.	10.6	32.	10.6
5	Todd D. D. & Const. Co.	*29.9	8.9	29.9	8.9
6	Todd D. D. & Const. Co.	*23.8	1.8	23.8	1.8
7	Beth. S. B. Co. (Fore River)	2.	1.2	0.	0.
8	Beth. S. B. Co. (Fore River)	2.	1.2	0.	0.
9	Wm. Cramp & Sons Co.	17.	....	16.	....
10	Wm. Cramp & Sons Co.	17.	....	16.	....
11	Wm. Cramp & Sons Co.	6.	....	5.	....
12	Wm. Cramp & Sons Co.	6.	....	5.	....
13	Wm. Cramp & Sons Co.	6.	....	5.	....
Miscellaneous					
Fuel Ship No. 16, Brazos	Boston Navy Yard	Del'd. 10	31/19	98.8	98.7
Fuel Ship No. 17, Neches	Boston Navy Yard	38.9	29.1	33.4	23.1
Fuel Ship No. 18, Pecos	Boston Navy Yard	17.5	.2	16.7	.2
Gunboat No. 21, Asheville	Charleston Navy Yard	90.	87.	86.	83.
Gunboat No. 22, Asheville	Charleston Navy Yard	7.7	5.7	6.5	5.5
Hospital Ship No. 1, Relief	Phila. Navy Yard	57.	52.5	53.5	48.5
Amm. Ship No. 1, Pyro	Puget Sound Navy Yard	98.	96.	97.	93.
Amm. Ship No. 2, Nitro	Puget Sound Navy Yard	73.	59.	68.	54.
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	12.	0.	7.	0.
Destroyer Tender No. 3, Dobbin	Phila. Navy Yard	4.3	1.5	1.3	.5

* No progress on account of strike.

There are 125 destroyers, 54 submarines, 3 mine sweepers, 12 seagoing tugs, 7 harbor tugs, 9 oil tankers and 1 Ford eagle in various stages of completion.

There were completed and delivered to the Navy Department during the month of October 11 destroyers, 4 submarines, 3 mine sweepers, 2 seagoing tugs, 2 oil tankers and 23 Ford eagles.

There are in addition 12 destroyers and 10 submarines authorized, but not under construction or contract. Miscellaneous vessels authorized but not under construction or contract (3): 1 submarine tender No. 3, 1 destroyer tender No. 4, and 1 transport No. 2.

NAVAL POLICY

IS OUR NAVY IN PERIL?—A situation has arisen in the United States Navy which, unless it be met and mastered, threatens to undermine its efficiency, and this at the very time when it has reached the highest state of efficiency in its long and honorable history. We refer, of course, to the serious crisis with which the navy is threatened, if, indeed, the crisis has not already come, with regard to its personnel, and by its personnel we refer to both officers and men.

It is well known that the demands of the war resulted in a vast increase, both in the number of ships in commission and under construction, and in the personnel necessary to man them; and it is also known that immediately upon the signing of the armistice steps were taken to put a large number of ships out of commission and gradually reduce the personnel to the requirements of a peace-time basis. So urgent were the appeals of the reserve force to be permitted to return to civil life, that the pendulum has swung too far, it seems to us, in this direction, with the result that our navy is already under-manned and promises to be even more badly undermanned in the near future, unless very strenuous steps are taken to stimulate enlistment.

We confess to having been greatly disappointed to find how few of the enlisted men in the reserves were sufficiently enamored of the naval service to make it their permanent calling. We had hoped that thousands of these young men would feel the lure of a life upon the sea, particularly when it meant service under the flag in a navy which had won such high distinction in the great world war. Of course, the great majority of the reserves joined the navy in order to help their country in the great emergency, and now that the danger is past, they feel that they are justified in returning to their jobs in civil life. We still believe, however, that the demobilized reserve forces will prove to be a fruitful recruiting ground, when the natural desire to get back to friends and familiar surroundings has been satisfied.

Undoubtedly, the most powerful factor in bringing about the present crisis is the enormously increased cost of living and the greatly enlarged salaries and pay, which is one of the legacies of the war. How seriously this matter is affecting the officers is shown by the fact that, several weeks ago, it was stated that over fifty officers had sent in their resignations and were living in hopes that they would be acted upon favorably. If, as statistics furnished by government officials state, the purchasing power of the dollar has decreased 45 per cent, it will be understood that the question of maintaining themselves on board ship and their families on shore, is a far more serious problem than it was in pre-war days. So far as the men are concerned, it needs no argument to prove that the great increase in the pay of labor which has taken place has rendered life in the navy, judged from an economic standpoint, far less attractive than it was. Take this as a single instance: one of the contracting firms that is building our subways recently informed us that the unskilled laborer, who before the war received \$1.75 a day, now receives \$4.00; and we know that skilled labor pay has risen from \$6.00 to \$8.00 a day and upwards.

Now these are the facts and it is for Congress to determine how it will meet the situation. Service in the navy is just as noble a profession as ever it was, and for the enlisted man, at least, it is far more comfortable than it was in the last decade. Something must be done or we must be content to see our navy shrink to a point where the interests and the dignity of the United States will be very seriously imperilled. Battleships are under-manned and we would not dare to state how many of our destroyers and other of the smaller craft are swinging at their moorings or tied up at a dock, with not even sufficient men to give them decent care.—*Scientific American*, 10/18.

ESTABLISHMENT OF PACIFIC FLEET.—Criticism of the establishment of the United States Pacific Fleet appears in an editorial in the October issue of the *World's Work*, under the heading, "The Navy Repudiates Admiral Mahan." A navy officer in a position to know ultimately the reasons which led up to the organization of the Pacific Fleet commented on this in an interview defending the Navy Department's action in the matter. The *World's Work* holds that "Mr. Daniels has done precisely the thing against which Admiral Mahan warned ten years ago," and has departed from the principle of concentration which Admiral Mahan contended was the basis of naval strategy. The navy officer we quote said:

"The decision to organize the Atlantic and Pacific fleets of equal strength is based on strategical and administrative reasons that are absolutely sound. The result of organizing two powerful fleets, one in the Atlantic and one in the Pacific, will undoubtedly greatly improve the efficiency of the navy as a whole." This, as Secretary Daniels stated at the time of the fleet reorganization, is expected to result from greater opportunities for carrying on war-problem exercises on a large scale from the spirit of competition in target practice, engineering records and other various forms of fleet exercises and training. He continued:

"It is a mistake to regard the navy as being 'divided' in the sense that the two fleets are widely separated and, therefore, do not support each other. The fleets are not widely separated for we now have the Panama Canal, which permits the two fleets, at all times, to be in close touch with each other. Either fleet could be sent from the main strategical positions on one coast to those positions on the other coast within a period of seven days; a period less than that required for an enemy of any important strength to attack either of our seacoasts. In fact this plan greatly increases the protection of each coast and therefore insures the greater protection of the nation as a whole. Protection of either of our long coast lines not only depends upon the ships themselves, but very materially upon the establishment, size and location of naval bases and navy yards. Such bases will only be properly developed when they are used by a large force of ships during peace times.

"The general principle enunciated by Admiral Mahan that the division of a naval force necessarily weakens the strength of the entire force as it enables the enemy to attack one part of the divided force, is true. The result of the division of the British Navy in the Revolutionary War and the Russian Navy in the Russo-Japanese War illustrate this principle. Whether or not the organization of two fleets in the American Navy violates this principle is a question. In my opinion it is only violated when a force is so divided and so widely separated that the two or more parts cannot support each other. Our Atlantic and Pacific fleets are not thus widely separated. They are so close at all times that one can come to the immediate assistance of the other in case of any impending danger. Strategically, therefore, the new organization does not offend against the principles as enunciated by Admiral Mahan. Consolidation of the two fleets into one was foreseen and it will be carried out in exercises which will combine the two fleets in one. The divisions of the two fleets bear certain serial numbers, consequently when they come together each division already

has its assigned place in the battle formation. Orders also have been given designating which of the fleet commanders shall be in supreme command of the combined fleet. In other words, the admirals commanding the different units of each fleet know exactly what the position of their divisions of ships would be in the battle formation of the combined fleet. Only recently was it possible to organize the two fleets, because two essentials were necessary, one the Panama Canal, the other a sufficient number of various types of ships in the navy to enable us to organize two fleets consisting of all the essential types of vessels to make each fleet a properly balanced fighting force. In my opinion there is no sound argument which can be advanced against the new organization of our sea power, while there are very many reasons which justify it."—*Army and Navy Journal*, 10/11.

AVIATION INSTRUCTION AT NAVAL ACADEMY.—Recognition of the desirability of furnishing the ground work, at least, of military aviation in the established military and naval academies, so frequently expressed by army and navy officers who discuss the relative importance of the new services which have come out of the World War, has at last been extended by the U. S. Naval Academy, however. The suggestion originated with Capt. Thomas T. Craven, director of aviation in the office of Naval Operations, Navy Department, and it has been approved by Rear Admiral A. H. Scales, Superintendent of the Naval Academy. In consequence it is proposed to incorporate in the courses at the academy subjects having to do with aeronautics. In outline the plan does not go very deeply into the theory of aeronautics, but in certain courses there will be an amplification particularly helpful in the mastery of aeronautical science. For example, in physics and chemistry and in the study of gases amplification would be simple; in mechanics the plan would embrace the problem of structure; in navigation, the variations incidental to the navigation of aircraft; in gunnery, aerial bombing and marksmanship from aircraft. In addition it is proposed to give the first class a series of lectures on kite balloons, the operation of dirigibles and seaplanes.

In connection with this plan of amplification of courses to incorporate the fundamentals of aeronautics, there is now in process of consolidation a complete exhibit of aviation material which will be installed at the Naval Academy. This exhibit will embrace models of heavier-than-air and lighter-than-air aircraft, motors, instruments covering meteorology and navigation, armament, hydrogen, helium and general accessories. Although the plan means a very modest beginning in the fundamentals of aeronautics, it is confidently believed that it will justify itself and warrant expansion as the plan is developed. It is recognized, particularly by the line officers of the navy, that the progress of aeronautics as applied to sea power must come up through the regular service and that the navigators of lighter-than-air craft and the pilots of heavier-than-air aircraft must furnish the nucleus from which expansion is possible in time of emergency. Training of navigators and pilots, it is believed, can never be incorporated with the academic work of the midshipman, but will come after graduation and experience and seasoning at sea through instruction at the abundantly well-equipped navy air station at Pensacola, Fla. Officers view with approval the outline for amplifying the courses at the Naval Academy to embrace aeronautics, and are practically a unit in conviction that navy air service is distinctly a naval problem.—*Army and Navy Journal*, 11/1.

MATÉRIEL

FOREIGN AIRPLANES FOR U. S. N. SHIPS.—Negotiations of the Navy Department with the War Department with regard to procuring Sopwith strutters, Sopwith camels or Nieuport airplanes for shipboard use has resulted in the shipment to the navy airplane factory at Philadelphia of

approximately 30 machines. These airplanes will be overhauled at the factory and will be fitted with flotation gear. It is expected that 16 will be ready for assignment to ships about January 1.—*Army and Navy Journal,* 10/25.

STATUS OF PLANES AND ENGINES.—The Air Service on October 15, reported 9586 planes and 32,033 engines of all types on hand; 54 per cent of the planes and 57 per cent of the engines were of the active class. Of the active class of planes 337 were in commission, 4091 in reserve, 739 out of commission; total, 5167.—*Army and Navy Journal,* 11/1.

THE UNITED STATES NAVY.—The Acting Secretary of the Navy, says *The Iron Age,* under date Washington, September 1, desires an enlarged appropriation. He asks Congress for an additional $18,900,000 for navy repair and construction work. Two motives have inspired this request. The first is the seriousness of the international situation, including the delicacy of the Ameircan-Japanese relations. The second is the fact that unless this additional appropriation is made, work would have to be cut down in many navy yards. "The Chief of Naval Operations, who is charged with the operations of the fleet and with preparation and readiness of plans for its use in war," says the Acting Secretary, "has stated that in his professional opinion he considers it important, if not urgent, that every fighting unit of the fleet should be put in fighting condition at the earliest possible moment, and that if the appropriations are not adequate for accomplishing this, steps should be taken to have them augmented to the extent estimated to be necessary. While it is no more important or urgent at this time than when the current appropriations were in the course of making, it cannot be denied that the opinion of the Chief of Naval Operations is fundamentally sound."—*Engineering,* 10/3.

NAVY WILL DEVELOP ALASKA COAL FIELDS.—Twenty-eight million tons of coal suitable for naval use is in the Matanuska field, according to the report of the Navy Department commission, which recently completed an exhaustive survey. The information is of particular value since the establishment of the Pacific fleet which can use the northern supply without the necessity of transporting the coal through the Panama Canal. The report, which has not yet been made public, recommends that the coal be brought to the seaboard at Seward and Anchorage.—*The Naval Monthly,* Oct., 1919.

DESTROYER "CHANDLED" DEVELOPS HIGH SPEED ON TRIALS.—The destroyer *Chandled* attained a speed of 36.32 knots on her standardization trial on the Rockland, Me., course on August 21. She averaged 35.64 knots on her five top-speed runs. The vessel develops 28,032 horsepower. —*The Naval Monthly,* October, 1919.

SUBMARINE "AA-2" COMPLETES TRIAL TRIP WITH HIGH SPEED.—The submarine *AA-2,* the latest of the U. S. cruising submarines, was launched at the Fore River yards of the Bethlehem Steel Corporation at Quincy, Mass., on September 6. The submarine is 370 feet long and said to be the fastest Diesel-engined boat afloat, with a surface speed of 20.8 knots, made on her trial trip, and a submerged speed of 13 knots. She has a cruising radius of 7000 miles. The ship has a tonnage of 1150, the next being the *S* type of 850 tons.—*The Naval Monthly,* October, 1919.

PERSONNEL

NAVY SHORT 64,794 ENLISTED MEN.—The enlisted personnel of the U. S. Navy on October 20 was 117,782, a loss of 565 in the week ending that day. Of this total 8768 were reservists. As the authorized strength

is 191,000 men, the navy is short 64,794 in enlisted personnel. Conditions relative to undermanned ships have grown no better in the last few weeks. The U. S. S. *George Washington*, which is soon to sail for France with the King and Queen of the Belgians, is short 400 firemen and seamen, and Admiral Wilson, commanding the Atlantic Fleet, has been called upon to supply the shortage. Orders issued to man twenty-one tankers and colliers resulted in a supply of men for only eight of these ships, the men being taken from the battleships and cruisers. It is likely that the U. S. S. *Delaware* will be assigned to the duty of taking to Italy the body of the late Italian Ambassador, Count V. Macchi di Cellere, who died this week in Washington.—*Army and Navy Journal*, 10/25.

NAVY RECRUITING CONTINUES FALLING OFF.—The week ended October 16 brought a total of 1491 recruits to the navy, a loss of 123 over the previous week. The six divisions reported these totals: New England, 184; Eastern, 535; Central, 339; Southern, 134; Southwestern, 138; Western, 143. From October 9 to October 16 the Pacific Fleet reported no enlistments and the Atlantic Fleet 18. Only 45 reservists transferred to the Regular Navy and there was a total of 200 re-enlistments during the week.—*Army and Navy Journal*, 10/25.

NAVY SCHOOL OF METEOROLOGY AND AEROLOGY.—The establishment of a school for training of enlisted men of the U. S. Navy in meteorology and aerology was announced October 21 at the Navy Department. The school will be located at the Naval Air Station, Pensacola, Fla., and the course will be four months. While it will start with a capacity of only twelve students, expansion is provided for. The first class will open November 1 and the second class December 1, and new classes will be inducted into the school as each class is graduated. Requirements for candidates are at least two years in a recognized high school or its equivalent, and it is desirable that candidates have a knowledge of elementary physics, mathematics and physical geography. All transfers, which will be restricted to candidates having at least one year and ten months to serve on current enlistment, will be made by specific order of the Bureau of Navigation. Graduates of the school will be given ratings in accordance with their ability and assigned to duty at the navy weather observation stations operated in connection with the various navy air-stations and on board aircraft tenders.—*Army and Navy Journal*, 10/25.

NAVY LINE OFFICERS' RESIGNATIONS ACCEPTED.—Secretary Daniels issued instructions on October 29 that with one reservation the resignations on file of officers who were graduated from the U. S. Naval Academy should be accepted. The reservation affects officers who have been in the service eight years or less and is based on the ground that on entering the Naval Academy these men signed a contract for eight years and their parents also signed it, and for that reason they should, without question, serve to the end of their contract, four years in the Naval Academy and four in the navy as ensigns. As a matter of fact, due to the war, the officers who come within the eight-year reservation are all in the grade of lieutenant (j. g.) or of lieutenant and it is considered that they have been especially favored and have no good reason for leaving the service, particularly in the matter of pay, which for their grade is more than any raise proposed considering that normally they would still be ensigns. The acceptance of the resignations will affect officers from the grade of commander down, about fifty officers of the Regular Navy approximately. There is some feeling that the Secretary might reconsider his reservation because officers declare that it will be of no benefit to the service, but will affect the morale of the officer personnel to retain dissatisfied elements, whether or not this element may represent only the lower grades. This view comes from officers who, realizing the irksome conditions of the commissioned officers

of the navy due to the existing economic conditions, are deeply concerned that the morale of the service be held as high as is possible at this crucial time and that the department do everything it can to keep the loyal and efficient officers of the navy in a contented frame of mind.—*Army and Navy Journal*, 11/1.

RETIRED OFFICERS ORDERED HOME.—All retired officers of the U. S. Navy now on active duty have been ordered relieved and ordered to their homes. The orders affect some 200 officers all on shore duty, and by November 15 it is expected that all the retired officers will have been relieved. Some of the officers have been occupying important billets, and their places in some instances where experience counts will not be so easy to fill.—*Army and Navy Journal*, 11/1.

NAVAL CLOTHING FACTORY UNIFORMS.—The naval uniform factory at the navy yard, New York, is now prepared to make uniforms for such officers as desire to give orders for them. A number of officers have already been measured and have given orders for uniforms. Only the best material is used. A uniform for an officer from commander down is furnished for $48. Uniforms for officers above the grade of commander cost but a few dollars extra.—*Army and Navy Journal*, 11/1.

NAVY MEDICAL CORPS SHORT 300 OFFICERS.—The Medical Corps of the navy is now 300 short of its permanent authorized officer personnel. Up to October 15 there were 160 resignations accepted or pending, an increase of thirty since the first of the month.—*Army and Navy Journal*, 10/25.

TRAINING OF FLYING PERSONNEL.—In the Navy Department there is an officer here and there who is of the opinion that the greatest aid and comfort from his service given the proponents of a single air service comes from the fact that up to the present time little of a constructive nature had been evolved by the department in the preparation of an adequate flying personnel representative of the Regular Navy. This opinion coincides with that of Regular Army officers of experience in aviation who point out that while last May the Chief of Staff stated that "the Air Service is a fourth arm of equal importance with the other branches of the service," there has been as yet no indication that the War Department had taken steps to realize on the importance of the Air Service, nor to plan for a constant flow of young Regular officers who should be trained as pilots into the Air Service, either from the U. S. Military Academy or from any other army school. These officers, both in the navy and in the army, contend that the appointment of officers from the line to aviation duty will retard rather than assist in the military development of aviation, and minimum results are only to be expected through such a method. Some plan, beginning at either of the established academies, or at a special academy for training in aeronautics, must be adopted, they assert, in order to produce the all-around military officer who, when in the air, is capable of understanding movements on sea or land and of competently co-ordinating his duty with the commander of such movements. "We are paying much attention to the education and vocational training of the enlisted personnel," said an army officer, who added: "There is far more reason for training the officer personnel and educating it in the technical, mechanical and operating sides of aviation."—*Army and Navy Journal*, 11/1.

NAVY INCREASED PAY BILL IN SIGHT.—Final hearings of the subcommittee of the House Committee on Naval Affairs on the bills proposing increased pay for the commissioned and enlisted personnel of the navy will probably be held on Nov. 4. Secretary Daniels and Rear Admiral Thomas J. Cowie, U. S. N., will be heard. It is reported that the committee has the matter so well in hand that it will report a bill in the House when

Congress reconvenes on Dec. 1. It is predicted that the measure will differ radically from the Stiness bill and the draft suggested by officers of the Navy Department.—*Army and Navy Journal*, 11/1.

MERCHANT MARINE

SHIPPING BOARD GETS LINERS.—Formal custody of five of the eight former German passenger ships, title to which is now a subject of diplomatic discussion between the United States and Great Britain, was transferred last week from the War Department through officials of the port of embarkation, to the United States Shipping Board. The ships transferred are the giant liner *Imperator*, the *Mobile* (formerly the *Cleveland*), *Pretoria*, *Prinz Friedrich Wilhelm* and *Zeppelin*, aggregating 111,393 gross tons.

These ships were taken over by the Allied Commission in German ports following the signing of the armistice, and were allotted to the United States to bring troops home from France. The *Imperator* and some of the others were presumed to go to Great Britain and the Cunard and other lines now have in New York more than 1000 men ready to man them. On the day that the *Imperator* was to be turned over to the Cunard line, however, the delivery was interrupted on an order from Washington.

Officials of the United States Shipping Board said that they had no instructions as to the disposition of the ships, but would hold them pending orders, the only difference in so far as their status was concerned being that Shipping Board crews would replace those which have been operating them under the jurisdiction of the army service. It is also probable that they will remain at the army piers until the question as to their disposition is settled.—*Shipping*, 10/22.

AMERICAN MERCHANT FLEET.—The seagoing fleet of American merchant ships of over 1000 gross tons each on August 31, 1919, registered for the foreign trade or enrolled for the coasting trade by sea, as shown by the returns of the Bureau of Navigation, Department of Commerce, under acts of Congress, comprised 2245 ships of 8,100,008 gross tons, of which 1558 of 6,707,820 gross tons were steel steamers, 347 of 840,611 gross tons were wooden steamers, 95 of 180,487 gross tons steel sailing ships or schooner barges, and 245 of 371,099 gross tons wooden sailing ships or schooner barges.—*Shipping*, 10/7.

SHIPS CONSTRUCTED AND OFFICIALLY NUMBERED IN SEPTEMBER.—As might be expected, in view of the many disturbing influences at work in the spheres of commerce and industry and in some measure entirely aside from these because of the natural tendency of the business pendulum to extreme sensitiveness even under normal conditions, a falling off in vessel construction and registration has to be noted for the month of September as compared with that of August. There is nothing in the situation, however, to cause alarm among well-wishers of the permanent maintenance of our shipbuilding achievement.

The Bureau of Navigation, Department of Commerce, reports 200 sailing, steam, gas, and unrigged vessels of 374,165 gross tons built in the United States and officially numbered during the month of September as follows. This compares with 454,887 gross tons in August for 236 vessels. —*Shipping*, 10/22.

HOG ISLAND SHIPYARD OUTPUT.—With the delivery of the *Nobles*, a 7800-d. w. t. freighter, the Hog Island shipyard completed delivery of its first 50 vessels to the United States Shipping Board. The total tonnage delivered is 391,250 d. w. t. This is the world's record for shipbuilding in a single yard.

The total tonnage delivered by the American International Shipbuilding Corporation (Hog Island Shipyard) is 105,705 d. w. t. greater than the

dead weight tons of seagoing vessels delivered from American yards for the year 1916, which was the record pre-war year in ship production. In that year (1916) there were built in all yards in the United States 38 seagoing vessels of 1500 d. w. t. upwards, totaling 285,555 d. w. t.—*United States Bulletin*, 10/13.

SHIPPING BOARD PLANS FOR 1731 OIL BURNERS.—With the completion of the present construction program of the Shipping Board, there will be under the American flag 1731 oil-burning steamers of an aggregate of nearly 10,000,000 dead weight tons. Fuel stations are now being established along the trade routes in the Atlantic and Pacific so that the American ships will be able to make a complete circuit of the world without taking fuel at other than American-owned stations.

A total of 486 oil-burning ships is now in the government merchant fleet, while 67 others have been sold to Americans or reconveyed to their American owners. In addition 636 oil-burning vessels are under construction.—*N. Y. Times*, 11/2.

PRESENT STATUS OF OUR MERCHANT MARINE.—The following work yet remains to be done on our Merchant Marine program:

Completion of vessels launched but not yet delivered, 1,280,483 tons. Completion of vessels whose keels have been laid, 2,190,736 tons. Completion of vessels under contract, 984,407 tons, making a total tonnage on which work yet remains to be done, of 4,455,626 tons.

Of equally, if not greater importance than the construction of ships, is the provision of a well-trained sea-going personnel. At the present time we have 4592 deck officers and 4592 engineering officers. The deck force consists of 15,720 men and the engine and fire room force of 18,720 men. In the steward's department there are 7936 men, making a total personnel in our merchant marine under the Shipping Board, of 51,560.—*Scientific American*, 10/11.

NEW WAYS TO FLOAT SUNKEN SHIPS.—More ships were sunk during the four years of war than in any similar period of history. The vessels themselves are valued in billions; and in many cases their cargoes are still more valuable and are usable if recovered. It is small wonder that ship-salving has suddenly stepped to the front as a business and that all sorts of schemes are being hatched to recover some of this valuable property. Especially is the busy inventor trying to devise a way to raise vessels sunk in deep water—far beyond the limits of depth at which divers hitherto have been able to operate. Some new schemes for accomplishing this aim at protecting the diver against the crushing pressure of the water at these depths. Others endeavor to make this unnecessary by devising machines that will work automatically at these depths, doing away with divers altogether. Mr. V. G. Iden writes an interesting article in the *Marine Review* (Cleveland. October), which we summarize as follows:

"England, France and Italy have shown an active interest in the work of salving the vast amount of tonnage sunk during the war. Germans are also reputed to have ambitions in this direction. During the war our own government undertook some developments along this line, but since the cessation of hostilities our salving has been handed back to private interests. Something between five hundred thousand and a billion dollars worth of ships have been sunk off our coasts. Furthermore a number of American vessels have been sunk in European waters. Although some of our vessels were sunk in foreign waters, the United States has refused to relinquish claim to their ownership and the salvage work attempted on them will undoubtedly be in the interest of American owners.

"National claim to vessels sunk during the war, no matter what their locality, is being advanced by all the maritime nations. The old contention that a nation could claim ownership of nothing sunk outside the three-

mile limit, is being exploded. If the new basis of ownership is adhered to, it is doubtful whether the Germans will ever be permitted to carry out their reputed intention of reclaiming much of the merchant tonnage which their own submarines and mines sunk during the war.

"At the same time, the salving of vessels to-day presents more than the ordinary problems of recovery with which we have had to contend heretofore. Vessels representing great wealth have been sunk in the ocean at

COLLAPSIBLE PONTOONS FOR RAISING SHIPS.

depths much beyond anything divers have worked before. It is claimed that divers cannot work successfully at a depth greater than 80 feet because the water pressure is too great. Inventors have therefore turned their attention to the problem of protecting the diver from the water pressure.

"The Atlanta Engineering Corp., of New York, proposes to build one style of deep-sea armor. The first suit was of cast steel from the waist to the feet with a large cylinder tank encompassing the hips in which it was proposed to carry air bottles. The suit from the waist up was constructed of an aluminum composition. It has been decided that the large

cylinder around the waist made the armor cumbersome, and in the next suit this feature will be eliminated and the trousers made of gun metal. The whole will be built upon the ball and socket principle so as to give freedom to all the limbs of the diver.

"The American Salvage Co., New York, has attempted to eliminate the danger of diving by proposing to use a device constructed upon the

BURROWING MACHINE TO BORE UNDER SUNKEN SHIPS.
It has been tried out by a ship-raising firm of New York.

submarine principle. This is shaped like a ball and the men sent to work on the sunken vessel will work from its interior. It is known as the Sisson deep-sea diving machine, and has been tested in the waters of Long Island Sound. On the front of the machine are four electro-magnets with a pulling power of about two and one-half tons each. These magnets are operated in pairs by a motor within the machine which permits of the machine being moved to a predetermined point along the side of a steel vessel, by energizing and de-energizing the magnets, and using them in con-

junction with the screws. Steel air bottles under high pressure carry enough air for the operators. In case of emergency, the machine is equipped with ballast tanks which can be exhausted, thus permitting the machine to come to the surface of its own buoyancy.

"The plan of operation is more or less as follows: Pontoons of a predetermined size are lowered alongside the wreck. They are equipped with cables placed about two feet apart; each cable has a float, also an expanding hook. These hooks are banded together so that they will face outward or forward. The machine is about neutral in the water, and determines its position by means of the lower propellers; the rear propellers move it forward and the magnetic thrust arm picks up one of the hooks attached to the pontoon. The four electro magnets are then energized and the drill drills a hole and by releasing the two vertical magnets the machine moves over until the hook is directly opposite the hole that has been drilled, the magnetic thrust arm then moves forward and inserts the expansion hook in the hole. This operation is repeated until a sufficient number of pontoons have been attached to the ship to raise it.

"During the war the Navy Department made use of the hydraulic method of passing chains under a vessel with some measure of success. A high power hose was used on a vessel which was not extremely deep. The water pressure at that depth was 23 pounds and the hose threw water under a pressure of 150 pounds. The diver directed the nozzle, which was extremely long, at the sediment under the vessel and when a passage had been blown completely through, the nozzle was disconnected and a cable drawn under. Chains were attached to the end of the cables, and these were later attached to specially constructed pontoons.

"In cases where the ship has settled deep into the sand and mud at the bottom of the ocean it would be impossible to dig under it with either a hose or any other method now in use because as fast as the sand was removed it would fill in again. To meet such a condition as this, the burrowing machine has been invented and is being promoted by the United States Ship Salvage Participating Syndicate of New York. This is a box-like machine which is pulled through the sediment and under the ship by two screw-like blades operating in opposite directions.

"A further adaptation of this burrowing principle has been devised by the same people by an application of the tank which was invented during the war. Instead of two traveling belts, however, this machine has four, two working together in opposite directions. The nose of this machine has a hydraulic spray attachment which will assist the progress of the 'caterpillar' by blowing away sediment. This machine also is operated by hydraulic power and draws chains under the ship.

"The interocean Submarine Engineering Co. hopes to obviate the necessity of using pontoons in deep-sea work by utilizing the water-tight compartments of the sunken vessel. Where this practice is followed it will be necessary to send divers down to seal all the hatches and holes. In the shell of the water-tight compartments a hole will be cut over which is fitted in patented valve plate. Through this valve compressed air can be pumped into the compartment and the water forced out.

"In harbors it is possible to use pontoons and other simpler means of raising a ship, but it becomes increasingly difficult to use pontoons in the ocean. The large pontoons the English have built, however, may be considered somewhat different. These, constructed of cement, are in reality the half sections of a dry dock. It is planned to lower one on either side of a ship, pump the water out and bring her to the surface.

"But after diving for a ship, it is often found necessary to cut away some of the structure in order to get to work on the vessel. Sometimes it has been found utterly impossible to do anything with a sunken ship because it was impossible to cut away certain structures. Merritt & Chapman, of New York, believe they have largely met this problem by the use of an under-water cutting machine. This machine is an adaption of the acetylene cutting flame. It has been patented in this country.

"In the Chapman system of under-water cutting the flame is supported by a constant electric arc. The Germans also have a method where the flame is supported by compressed air and a shield. The flame, however, is started by an electrical spark. The English likewise have a machine to cut underwater, but theirs is an electrical method entirely."

The field for inventors is limited somewhat by the caution of the commercial ship-raising firms, for we read:

"Salvaging work is still progressing along the accepted lines, while inventive genius has been exhausted upon the many ideas advanced for raising the numerous vessels that were torpedoed and mined in the ocean. But daring attempts to raise vessels from the bottom of the ocean will probably not have the sanction and the support of the commercial salvagers for some time to come. They hesitate to work on experiments because such work does not hold profit for them. It is too much of a gamble. Commercial salving must be assured of a reasonable return upon its expenditures.

"Since the war salvage experts have been striving to find a way to do away with diving. If this can be accomplished a great advance will have been made in the art of salving. One of the ideas advanced is known as the DeVito method. Instead of having several pontoons, but two pontoons are used hinged together at each end. These hinges are operated in connection with an air cylinder. When lowered the hinges are wide open and the pontoons will lie on either side of the sunken vessel. Air is then pumped into the cylinder which rises, closing the hinge and bringing the two pontoons close together, clamping them to the ship in a vise-like grip. The grip of the pontoons once established, water is pumped out of the pontoons thereby raising the ship."—*The Literary Digest*, 11/1.

NAVIGATION AND RADIO

FREAKS OF WAR WIRELESS.—Just before the 64-kilometer retreat of the German armies from the strongly entrenched Chemin des Dames position in 1918, the Allied Intelligence Department informed the General Staff the exact positions which would be evacuated. This was in spite of the fact that all the preliminary operations on the Berlin side were carried out with the utmost attempt at secrecy; that every movement up to the final withdrawal had been made at night; and that even divisional commanders in the German ranks were ignorant of the extent of the retreat. Wireless told the story.

No message telling this precious secret was intercepted. The Germans knew far too much to intrust this to errant ether waves. Yet from the enemy's use of wireless equipment the Allies obtained their positive information.

The reasoning behind it was simple, but it was not until 1918 that either side used the process—perhaps for that very reason. Most communication in the front trenches is carried on by telephone. "Buzzers" chit-chat incessantly. Some of their talk is important. More is merely trench gossip. A little is scarehead stuff calculated to start the foe guessing if he happens to be listening in with microphone.

The trench phone equipment is costly. On the German side toward the end of the war it was likewise irreplaceable. Whenever the decision was reached to get out of a certain sector, the Huns had first to move out their phone intruments, wire and stations. From the time this was started until it was fully accomplished, wireless played an increasingly important part. Every phone station gave place to a temporary wireless station, and the chatter, bluff and serious orders in code were sent in this manner for 10 days previous to the final withdrawal.

From previous experience, French, British and American spotters had become familiar with the coincidental increase in the number of wireless messages with the preparation for retreat. So, with this symptom well

developed along a 64-kilometer front on the Chemin des Dames, they had no difficulty in marking off the sector, and even in guessing accurately concerning the time the retreat would begin. Needless to say Allied artillery made the evacuation as difficult as possible.

Another queer situation which arose in the wireless department during the war was known officially for months as the "Nauen-Madrid Buzz." In May, 1916, it appeared for the first time, emanating from Madrid. It was a curious rustle of the spark unlike any message familiar to Allied operators, who of course looked upon it with suspicion and tried to make something out of it. For perhaps five seconds—and sometimes as long as 20—this peculiar phenomenon would occur. Then no more for perhaps a week. Until Nauen developed the same strange quality the buzz was diagnosed simply as an odd manifestation of "static."

But Nauen buzzed. Immediately all the wireless sharps in the Allied ranks tackled the problem. Though there was no direct proof to hand that Nauen also was not bothered by "static," the coincidence was ugly. So many means whereby the Huns obtained precious information concerning secret military matters had been uncovered already, that the Allies had become quite in the habit of regarding anything out of the ordinary as spy work. The best men were put on the job—and were baffled.

It is needless to detail the many theories which were held concerning this mysterious communication—for after the first weeks no one doubted that the buzzing was just this. The solution was reached through pure accident.

In studying foe wireless—which is in code, if important—the practice is to take down the message on a phonograph record. Then it can be decoded at leisure. One of the many dozens of records of the Nauen-Madrid buzz was being run. A young radio officer was attempting to solve the mystery. The spring in the machine ran down, and as he wearily reached forward to wind the box again he stopped, chilled by the excitement of a discovery. With the cylinder revolving at a very low rate something that might be a rapid message in code clicked from the horn!

Throttling down the speed adjuster on the phonograph, he ran the record as slowly as possible. His hunch was justified! There was certainly something there, though it went too fast to be caught.

He wrestled with the problem overnight. Next day he rigged up an electric motor to run his blank cylinder record at a prodigious rate of speed. When the buzzing occurred it was caught. Then when the record was re-run at a moderate rate the message was there! It was decoded shortly, and proved to be part of an important description concerning the disposal of Allied troops.

The secret was simply that at Nauen and Madrid each message was cut into a perforated roll. This was run through the sending apparatus at the speed of four hundred words per minute. Naturally it turned out to be a buzz to anyone not "in the know." At the opposite station they simply took it on the phonograph, and that was all there was to it.

The Allies managed to trace down many spies through the requests made by Nauen. In addition to this a great deal of erroneous information was sent through channels by which it would reach Madrid, and thence Nauen. After this there always was a third party on the line whenever the Germans and their agents in neutral Spain got talking together.—*Scientific American*, 10/11.

WIRELESS BETWEEN UNITED STATES AND GERMANY.—Wireless communication with Germany has been resumed in a limited way by the American Government, according to *Wireless Age*. Business communications between American houses and their agents in Germany are accepted in New York at 44 Whitehall Street, and other points where the navy has district

communication officers for transmittal to the transatlantic wireless stations at the Navy Department there and at Otter Cliffs, Me., where they are dispatched to the receiving station at Nauen, Germany. Similar communications are dispatched from Nauen to the United States receiving stations. Press dispatches to the extent of 500 words from this country and a similar number of words from Germany are also accepted daily.—*Scientific American*, 10/11.

WIRELESS AND SHIPPING.—There is a world-wide movement to increase the use of wireless telegraphy and telephony at sea. Many bills are being prepared or have been passed by foreign parliaments compelling ships to carry wireless. This movement looks to the freeing of wireless telegraphy from the world monopoly which has so largely retarded its more general development. Action is being taken in England and France, as well as in the United States, by the respective governments, to make wireless free. The Australian, British, German and French governments have their own wireless systems. Our own government is reported to possess most effective systems of both wireless telegraphy and telephony which would prove of immense value to our mercantile marine if questions of naval and military policy did not prevent them being disclosed for free public use.—*Shipping*, 9/6.

ENGINEERING

A CHEMIST'S DREAM COME TRUE.—American oil won the war: This statement is at any rate nearer true than most of the similar ones we see. Lord Curzon says " the Allies floated to victory on a sea of oil," and 80 per cent of it, during the last crucial months, came from the United States. That the failure of this source might spell ruin to the Allied cause was realized by no one more than by the Germans, who tried to concentrate their submarine efforts on oil tankers, and with considerable success. Their work gave our engineers something to think about and set on foot experiments in the use of pulverized coal on shipboard, to offset the loss of oil. The installation of pulverized coal burners and oil burners side by side on an experimental vessel suggested the mixture of the two fuels and gave rise to the so-called colloidal combination of coal-dust and oil which is the last word in motor-fuels. An article by Robert G. Skerrett, from which the above facts are taken, contributed by him to *The Rudder* (New York) under the heading that we use, contains additional interesting particulars. We summarize it as follows:

" The inner story of our efforts to maintain a steady movement of oil across the Atlantic reveals how desperate the situation was at times and with what determination and technical cunning certain of our experts set about devising relief of a unique nature. The best of this tale of achievement is that the efforts designed to meet a war crisis have yielded results which are bound to prove of the greatest economic value in the years of reconstruction and in the normal periods of peace. The scientists have evolved a new fuel—a fuel that brings together waste products and thus amplifies tremendously our sources of mechanical power.

" The war had not been long underway before the ravaging U-boat began taking an increasing toll of merchant shipping. To a large extent the foe's advantage was due to the telltale stream of smoke. This emphasized the desirability of smokeless fuel.

" Such was the prevailing status of anti-U-boat preparations when the Submarine Defence Association of New York City was created. This was called into being by a large group of representative underwriters, steamship lines, manufacturers, producers, and technical concerns of one sort or another—all of them civilian interests. One of the very first things attacked for solution by the Submarine Defence Association was the question of smokeless fuel. Without going into this subject at length, it will suffice

for our present purpose to say that particular attention centered before long upon the utilization of pulverized coal.

"The Navy Department had placed at the disposal of the Submarine Defence Association a converted yacht, the U. S. S. *Gem*, for diverse experimental work.

"The furnaces are designed for the burning of fuel oil. Two of the oil burners were removed and two pulverized coal burners substituted; and the tests included the use of coal alone and of coal and oil burned simultaneously from different but neighboring burners.

"The association of oil burners and pulverized coal burners in the same furnace on the U. S. S. *Gem* quite naturally raised the question in the mind of Mr. Lindon W. Bates, chairman of the Engineering Committee of the Submarine Defence Association, Why not combine the oil and pulverized coal and burn them so mixed from the same burner? This query was inspired by an economic problem confronting the Allies which was daily becoming graver. Month by month fuel carriers were being sunk in increasing numbers, and England, France and Italy were sorely distressed lest the supply of liquid fuel fail them.

"As Mr. Bates saw it, the immediate gain, if coal and oil could be combined, would be to reduce the amount of fuel oil to be moved from America to Europe by just that measure of powdered coal which could be supplied from native sources abroad. In other words, his aim was to make every gallon of petroleum perform a greater service and enable oil-burning steam plants to use the mixed combustible without any substantial change in their liquid fuel installations. This was a somewhat ambitious project, because it was fully recognized that the way to success bristled with difficulties. Indeed, many others had essayed the same scheme, but, at best, with results of little practical value. The stumbling block was the law of gravitation which inevitably brought about sooner or later the precipitation of the heavier particles and thus caused the bits of solid carbon to separate from the oil and to settle at the bottom of the containers.

"After months of tireless investigation and hundreds of painstaking tests, a combustible compound was produced, called 'fixateur,' which would do the trick. Twenty pounds of this secret preparation, when added to 2000 pounds of combined fuel oil, pulverized coal, and coal-tar, for instance, will neutralize gravitation and keep the dissimilar ingredients thoroughly mixed for protracted periods. This composite combustible is technically termed colloidal fuel.

"The Submarine Defence Association has declared that colloidal fuel can be utilized for marine steaming purposes under practically the same conditions and with as good results as with the navy high-grade fuel oil. Tests have shown that the colloidal fuel is as smokeless as navy high-grade fuel oil, and yet, by purposely overfiring, it is possible to generate a dense smoke screen when desired. It seems that grades of colloidal fuel may be prepared which, without replenishment, will give a warship or a merchant craft substantially 20 per cent more steaming radius than fuel oil of equal bulk stored in the same tanks!

"It seems that refinery waste—pressure-still residuals—such as oil, wax tailings, crude-oil coke, etc., can be utilized in the preparation of an efficient colloidal fuel. Similarly, coal coke, charcoal, lignites, brown coals, and coal dusts, which are ordinarily deemed of little value for steam raising, can be drawn upon to furnish the needful heat units in the form of solid particles of carbon."

The oil-burning vessel is a money-saver compared with a craft of like engine power which consumes coal. A 10,000-ton vessel on a voyage of 7000 miles requires 1600 tons of coal or only 800 tons of fuel oil, but 640 tons of the new combustible will answer instead of 800 tons of straight fuel oil! The transatlantic freight rate is substantially $50 a ton. Therefore, if we add 160 tons to the cargo-carrying capacity, we obtain an additional revenue on each crossing of $8000! Assuming a ship to make six round

trips each year, the total increase of income thus effected would be $96,000. Then Mr. Skerrett turns to another use of the new fuel that should interest all those who view with concern the steady drain upon our coal and oil supplies which must some day exhaust them. Nearly half our known petroleum supply, in fact, is now gone, and we are using larger and larger quantities every year. He tells us how to save part of it:

"And have we any other reasons for encouraging the use of this new-found economic fuel? Manifestly, colloidal fuel will save us a vast sum each twelvemonth if oil-burning plants on shore use this epoch-making combustible as far as practicable. Indeed, it is inevitable that something of the sort be done if we hope to prolong the life and sufficiency of our domestic petroleum resources. This bears directly upon every phase of our industrial life; touches all forms of transportation and relates to every kind of power-driven craft.

"A short while back the Secretary of the Interior notified the United States Senate that we had withdrawn from our known oil field quite 40 per cent of their estimated original content. With the present trend of consumption, so the United States Geological Survey points out, we shall be consuming crude petroleum a decade hence at the rate of 520,000,000 barrels annually! This brings home to us how necessary it is for us to conserve our native resources, to take steps to save where we can, and to employ substitutes as far as practicable. Colloidal fuel is one amazingly flexible means to this end. The Submarine Defence Association thus emphasizes the conservation of oil that might be effected by adopting colloidal fuel instead: The 2,900,000 barrels now brought to New England, if employed in colloidal fuel, could do the work of nearly 4,000,000 barrels of straight oil, and accomplish this with the marked economies and advantages inherent to producing and applying heat with liquid as against solid fuel. The prodigal waste of oil is sin to be repaid in sorrow. Its conservation and guardianship is the task of those upon whom this world-solemn duty has been unprecedentedly laid. Ways have herein been made straight to do so with injury to none and helpfulness to all."—*The Literary Digest*, 11/1.

A NEW MOTOR FUEL.—Shareholders in Petroleum companies will have received a shock by the statement that an inventor has hit upon a compound which when mixed with water, provides a fuel which can be retailed at fivepence per gallon. There will probably be a slump in petroleum shares if there is any foundation for the statement, and judging from a test which took place on Saturday, at Nottingham, the new fuel would seem to be *au fait accompli*. Several experts attended the test, which is the invention of a South American named Andrade, who is of Portuguese extraction. The fuel is produced by mixing with water a compound known only to the inventor. The test took place in the grounds of Alderman Ball, father of the late Captain Albert Ball, the airman. Alderman Ball has entered into a provisional arrangement with the inventor to secure the European rights. On some of the liquid being poured on to the ground it burned steadily and emitted no smoke. The smell does not resemble that of petrol. Half a bucketful of liquid was afterwards poured into the petrol tank of Mr. Ball's car, which traveled with perfect smoothness and at a high rate of speed. More water was then added, and this seemed, if possible, rather to improve the running of the engine.

Thirty Miles with a Gallon.—Mr. Ball states that the car traveled over 30 miles on one gallon, and that if Andrade's assertions are true a gallon can be manufactured for 5d. Great interest has been aroused among local motor firms by the discovery. Andrade claims that it will prove even more valuable for submarine craft as practically no air is necessary. The inventor has been in this country several weeks, during which time experiments have taken place in the presence of experienced motor experts. The

chemicals are introduced in the form of powders, and minor experiments are reported to have proved very encouraging. Further tests have yet to be made, however, before the new fuel can be considered to have established the claims of the inventor.—*United Service Gazette*, 10/16.

AERONAUTICS

NAVY'S GREAT AIRSHIP HANGAR.—The navy is purchasing its first rigid airship in England at a cost of $2,500,000. To house it a huge hangar is to be erected at Lakehurst, N. J., which will be 800 feet long, 265 feet wide and will have a clear inside height of 174 feet, while the total height from the ground to the peak of the roof will be over 200 feet. The steel framework will be over 6000 tons. Two elevators and several stairways will lead to the roof. The many shops necessary for the maintenance of the airships, will be built in between the great arched trusses that support the roof. Three railroad tracks will run the entire length of the building. The hangar will be large enough to hold one ship of 10,000,000 cubic feet capacity and a smaller one at each side, or two 5,000,000 cubic feet ships side by side.—*Scientific American*, 10/11.

AN AIRSHIP CONSISTS OF 20,000 PARTS.—Some interesting facts regarding the work required in building a large modern airship is given in a recent issue of *The Engineer,* which states that the general problems of design are closely allied to those of naval architecture; although the airship designer must be a highly skilled mechanical engineer, and also must have a knowledge of textile technology. For the work of construction, owing to the multiplicity of parts required, a very efficient shop organization is necessary. In a rigid airship structure, excluding the machinery, there are 20,000 different parts, a total length of structural material of 20 miles, 60 miles of wire, and over 2,000,000 rivets.—*Scientific American*, 10/11.

SPEED IN AIRPLANE TRAVEL.—That very successful airplane designer, Grover C. Loening, once made the surprising but perfectly true statement that the speed requirement for successful commercial aviation is more important to-day than it will be several years from now. In the course of a paper on the value of speed in commercial airplanes, he explained this on the ground that airdromes are less frequent and are more remote from cities than they will be in the future, and, therefore, speaking of the business man, the time from office door in one city to office door in another must include a motor-car ride to the airdrome, which will generally be far longer than the taxicab ride to the station.

Mr. Loening, whose monoplane is one of the fastest machines of the day, shows the significance of higher speed in an analysis of a business man's trip by airplane, from an office in New York to an office in Washington, D. C., by an airplane making 70 miles an hour. From his office in New York to Belmont Park would take about 50 minutes, and from Anacostia landing field to his Washington office, about 30 minutes, making a total of 4 hours and 50 minutes, which is certainly not enough less than the train time to warrant the added expense and trouble of going by the air route. But if the airplane could maintain 170 miles per hour, it would travel from Belmont Park to Anacostia Landing in an hour and a quarter, and with the same connecting trips to offices, the total time from office door to office door would be 2 hours and 35 minutes, which is less than half the train time. Thus a business man could leave his New York office at 8 a. m., reach Washington at 10.35, leave Washington at 2 p. m. and arrive at his office at 4.35.

The above estimate assumes perfect weather conditions with no wind. But let it now be supposed that a 20-mile head wind is blowing. A 70-mile-per-hour machine will take about four and one-half hours for its flight.

making a total of almost six hours, which is longer than the train time; while the 170-mile-per-hour airplane will make its flight at 150 miles per hour, in 1 hour and 28 minutes, making a total time of 2 hours and 48 minutes from office to office. The fast machine is less dependent on the weather.

We are entirely in agreement with Mr. Loening, in his statement that under existing conditions, whatever the future may have in store, very high speed is necessary if inter-city travel is to surpass railroad travel in the matter of time consumed on the total journey.—*Scientific American*, 10/11.

SILENT AIRPLANES.—Information emanating originally from Zurich is to the effect that several big German works, including Krupps, of Essen, are carrying out experiments in the most profound secrecy, with a novel aviation motor, much superior to all designs heretofore known. It is reported that they have constructed a gas turbine, one of the main advantages of which would be to give almost noiseless flight. Giant airplanes capable of carrying 64 people are stated to have been built, equipped with the motor in question.—*Scientific American*, 10/25.

ZEPPELIN AIR SERVICE.—Successful trial flights are reported as having been made by a great Zeppelin, driven by seven motors and able to carry 100 passengers, in addition to the crew. A Berlin source states that this is intended to be the first gun in a regular airship service by a German company, connecting Stockholm and Copenhagen with Berlin, the major object being the assumption of a leading position in Scandinavian affairs, as against British and French rivals.—*Scientific American*, 10/25.

MAYNARD'S FEAT.—Nothing in American aviation has been more thrilling than the achievement of Lieutenant Belvin W. Maynard in twice crossing the continent in a total flying time of about fifty hours.

When Maynard landed at Roosevelt Field he was hailed as the premier flier of the Army Air Service because he had shown superiority in this contest as well as in the New York-Toronto race, in which he was also the victor.

A message from Major Gen. William T. Menoher of the Army Air Service praised him for his courage and skill. The announcement was made that he would start soon on another transcontinental flight over a southerly course. In this flight he will use the De Haviland-4 plane, equipped with a Liberty motor, but stayed with streamline wires—an experiment which he was forbidden to try in the race just finished.

In recognition of his exploit Maynard has been recommended by Brig. Gen. William Mitchell of the Air Service for rating as a military aviator. This rating carries with it an increase in pay amounting to 75 per cent above his salary now as a first lieutenant in the Air Service. Maynard smiled when he heard this recommendation, and intimated that it was his intention to resign from the army within a year. He said it was probable that he would return to the ministry.

Credit in the victory was given by Lieutenant Maynard to his mechanician, Sergeant C. E. Kline, whose quick repairs at Wahoo and Cheyenne enabled the pilot to retain his lead in the race. Kline, who was described by Maynard as "the best mechanic in the Air Service," refused to accept the major share of the credit for the victory, and declared that only the flying of Maynard was responsible for winning the race. He described the "flying pastor" as the "army's best pilot," and declared that he would never work as mechanic for any one else so long as Maynard remained in the service.

In the last 500 miles of the race Maynard raced his motor with such speed that he covered the distance in about four hours, or at an average

speed of about 125 miles an hour, while the average rate of speed in the second lap of the flight was about 110 miles an hour.

Thrilling stories of incidents on the flights were told by Maynard and his mechanic. One was that he sighted a snow-covered peak while he was flying through a storm only in time to miss its crags by about 200 feet. He fought blizzards through the greater part of his flight over Wyoming, and said that in one of these storms he managed to pilot his plane through a lane of clear sky, with heavy winds and storms raging on both sides of his plane.—*Mid-Week Pictorial*, 10/30.

NAVY TO BUY WORLD'S BIGGEST AIRSHIP.—Negotiations are in progress and an early closing of the contract is expected for the purchase by the navy department of the British Rigid Airship *R-38*, the largest airship in the world, now under construction in England. Realizing the necessity of a fleet of airships and knowing that we are far behind Great Britain and Germany in lighter-than-air craft, Congress appropriated sufficient funds to start the construction of one rigid in this country and to purchase a rigid from Great Britain. Two and a half million dollars were appropriated for the purchase of this airship and for the training of the pilots. Through the hearty cooperation of the British Air Ministry with the Navy Department, the final arrangements for this purchase are about to be settled.

The success of the British in building and operating rigid airships is proved by the trip of the *R-34* to the United States and its return to England. While the Germans had many years start on the British, the latter have made a wonderful progress in the past few years. The *R-38* to outward appearances will look like the *R-34*, but her dimensions, horsepower, speed and radius of action will be very much greater.

The new airship when full of gas will have a 2,724,000 cubic feet capacity, which by way of comparison is 15 times of that of the *C-5*, the U. S. Naval dirigible that blew to sea and was lost last spring at Newfoundland just after a record flight up from Cape May and on the eve of an attempt to cross the Atlantic.

The *R-38* is 694 feet in length, 86 feet in diameter, 93 feet 6 inches high and carries a useful load of 45 tons. By comparison the *C-5* is 195 feet in length and 54 feet high. It is expected that the *R-38* will have a maximum speed of 60 knots.

The Air Ministry has offered to train personnel for the *R-38*, so that upon delivery this airship can be taken over immediately by an American crew and be flown to the United States. Officers and men in the navy who have training in airships will probably be sent at the beginning of the year to British Rigid Airship Stations.—*United States Bulletin*, 11/3.

MISCELLANEOUS

SEA POWER AND COMMERCE.—Maritime commerce is dominated by those nations which are the most powerful at sea. The profound influence of sea commerce upon the wealth of nations has always been recognized by historians, the rise and fall being due, in many important instances, to changes in their sea powers. So many destinies have been modified by sea battles that historians often state that the sea is the place where all national destiny is eventually decided. Carthage, the great commercial nation of ancient times, was destroyed by the Roman Navy. The Carthaginians and their relatives the Phœnicians were great maritime peoples. They possessed well-equipped navies, but the Roman Navy was superior in sea power.

Navies played an important part in the recent world war and as a result of it, the German Merchant Marine and Navy have been destroyed. The question now arises with respect to the effects these severe losses will exert on the future of the German nation. Will it recover from them? The Kaiser in 1914, just prior to the war, asserted that Germany's future

was upon the sea. The Germans had built up a great over-sea trade within a few years and possessed the second navy in point of power. They knew the value of sea-power through studying Captain Mahan's books.

Speaking of Germany's future after the war, Herr Ballin said in 1918 that immediately the war ended German ships laden with merchandise should be sent over all the seas, for the nation which restores her over-sea commerce first will become the wealthiest and most powerful. As a result of the pleas made in a speech in which this statement was made, there was a great amount of speculation in German shipping shares, industrial magnates like Stinnes, the Krupps, and others purchased controlling interests in ships, many new shipping companies were formed, shipyards were constructed and elaborate exporting operations were planned. The real conditions of peace have, however, nipped these schemes in the bud and to-day German sea-power belongs to past history.

" The world war has not yet been won," says the Italian historian Ferrero, "because there is political unrest everywhere. It will be definitely won by that people or those peoples who succeed in saving from universal anarchy an authoritative government." These are perhaps extreme statements made by an authority suffering from the temporary effects of adverse local political conditions.

The German admiral Von Tirpitz, perhaps, takes a more correct view when he states that Germany was destroyed by the war and adds: "It only remains for loyal Germans to concentrate themselves on the single aim of checking local political madness, holding up further ruin, and saving as much as possible of those which are our noblest possessions." Von Tirpitz further says that recent events have proved the Germans to have no capacity for the sea. They are unlikely therefore to revive their navy.

These recent judgments of the generally accepted greatest naval authority in Germany are opposed to the opinions largely held by foreign peoples. They are, however, well supported by facts and are probably sound. Should this be so, we may expect Germany, after many social disturbances, to settle down to a simple national life like that of Switzerland, while a new and more vigorous maritime star arises upon the sea. Will these United States of ours be that star?—*Shipping*, 10/29.

NEW GERMAN MERCHANT MARINE.—The German Government is planning the formation of a new German merchant marine. In order to give the German steamship lines, such as the Hamburg-American and North German Lloyd companies, the greater part of whose fleets was given up or seized during and after the war, a new start, the government has decided to begin the distribution of an indemnification grant estimated at more than 250,000,000 marks ($62,500,000). This will include indemnification for the ships and property of German steamship lines seized in New York and elsewhere.

Though this foreshadows the re-birth of the German merchant navy, its development will be slow, restricted by high wages and lack of raw materials, as well as shortage of shipyards, for the latter will be occupied with building 200,000 tons of shipping annually for the Allies to replace vessels sunk by the U-boats in the war.

From talks with leading men connected with the principal German shipping lines, it is inferred that their hopes lie less in the expectation to be able to rebuild the German mercantile marine within the next few years than in some working arrangement with American shipping companies whereby Germany would furnish some ships and also officers and crews, while the lines would be operated and controlled by Americans.—*Shipping*, 10/7.

NEW LIFE SAVING GUN.—In a series of tests made recently for the United States Steamboat Inspection Board, the new G-O Life Line Gun for throwing life lines met every one of the requirements established by the Board

and greatly exceeded the great majority of them. The G-O Life Gun requires no separate powder charge, wad or primer. The charge and projectile are one piece, thus eliminating the danger of moisture getting to the powder.

In one of the tests recently made, the cartridge case was immersed in water and then put into the gun and fired. In another, the barrel of the gun was filled with water, the cartridge inserted and successfully fired through the water, proving that any amount of moisture could not damage the cartridge or mechanism in any way. In none of the tests to which the gun was put was there a misfire or short shot. In every case the projectile went well beyond the mark without the breaking of a single line. The recoil was found to be perceptibly less than any other gun of like character, the teeth on the bottom of the carriage holding the gun firmly in place during all of the tests.—*Shipping*, 10/22.

THE FUTURE OF ST. THOMAS, U. S. A.—Shipping and commerce are the two factors that are going to decide the future of St. Thomas, Virgin Islands, formerly a Danish possession but now a part of the United States.

With shipping in connection with St. Thomas is generally understood ships calling for bunker coal, as the handling of coal has for many years been the main source of livelihood for the laboring class of St. Thomas, and it is the popular belief that St. Thomas is only of importance as a coaling station.

Of course, St. Thomas has had in times past and will have in the time to come great importance as a bunkering station, as well for coal as for oil burning vessels, but St. Thomas is without doubt destined to be much more than a bunkering station in the near future. By virtue of its excellent harbor and its marvelous site, it will undoubtedly some day be one of the shipping and commercial centers of the world.

St. Thomas is right in the track of the traffic between Europe and the Panama Canal and between the East Coast ports of the United States and South America, and it could easily be made advantageous for all the big liners which in the future are going to keep up these routes to make St. Thomas a regular port of call.

Owing to the great increase in the cost of ships and their running expenses, the future world shipping, in order to save time and money, must be based upon large ocean liners touching at certain easy accessible points for transhipment of cargo and passengers by smaller and cheaper vessels especially adapted for the service between these shipping centers and all the different small towns and harbors situated in the trade districts tributary to the various centers.

The hand of nature has endowed St. Thomas with all the qualifications required for being such a world center for shipping and commerce, and it may be hoped that the government and business men of the great country on whom the responsibility rests for the proper development of the unbounded possibilities of St. Thomas harbor, now will give their support and invest some of their money in order to improve the present facilities of the harbor, and restore and further extend the different inter-colonial routes for which St. Thomas was the center before the war.

St. Thomas should, by suitable passenger and cargo, steam or motor ships, be connected with every point of importance on the islands and South American republics bordering the Caribbean Sea; these ships should keep up regular and frequent routes, so that travelers could always be sure of finding shipping opportunities to their destination from St. Thomas, and so that merchants and shippers from all over the world could forward their goods on through bill of lading via St. Thomas to any point on the islands and shores bordering the Caribbean Sea, and vice versa.

The making of St. Thomas into an important point of transhipment would naturally bring about a considerable increase, not only in the

bunkering business, but also in the general demand of provisions and all sorts of merchandise whereby the local trade would greatly benefit.

But in order to assist this island in becoming such a great world center for international shipping and trade, St. Thomas should be made a free port. Being a free port, it would be possible for foreign merchants to store their transhipment goods here any length of time, without paying duty on it, and different raw material could be brought here for manufacturing purposes and exported as finished articles without any interference of customs authorities.

American manufacturers and merchants could make St. Thomas an emporium for American-made goods in the West Indies, when once the steamer connections as outlined above are established, as it is a well-known fact that in order to meet competition in foreign markets successfully, there must be ample supplies readily available at all times and the necessary facilities for shipping the goods in shortest possible time to any point required.

Such conditions would open up undreamed of perspectives for the inhabitants of St. Thomas. What a blessing for this island if we, instead of seeing mothers and young girls running with coal baskets on their heads, could see them taking care of nice clean homes and well-fed children kept up by sober, intelligent and industrious husbands and fathers, who by the proper developments of this beautiful little island, would be in a position to find steady and well-paid work.—*Shipping*, 10/7.

OUR WAR CASUALTIES 322,182 MEN.—The latest official figures, giving our war losses in dead and wounded, show that we lost 116,492 dead and 205,690 wounded, a total of 322,182. This includes army and marine losses on all fronts during the war and from the armistice to September 1, 1919. Of this total 35,585 were killed in action, and 14,472 died of wounds, making a total of 50,057. Disease accounted for 58,073, and 8092 died of accidents and other causes. There are no "missing," all of those so reported having been accounted for.—*Scientific American*, 10/11.

ARMY ITEMS.—The estimated strength of the army September 30 was 346,094, not including 223 Marines in the A. E. F. Of this number 29,163 were in Europe, 2373 enroute from Europe and 280,993 in the United States. The net decrease in army strength since November 11 is 91 per cent.

During the first 29 days of September 24,936 army personnel sailed from Europe, bringing the total embarked since the signing of the armistice to 1,933,901.

During the week ended September 27, 30,141 enlisted men were reported discharged. From November 11 to October 1 the total number discharged was 3,381,765. Of these 169,609 were officers and 3,212,156 enlisted men, the latter including 16,723 furloughed to the reserve. During the month of September a total of 8726 officers were reported discharged.—*Liason*, 10/25.

TANKS.—When we look back on the various mechanical developments during the war one is almost inclined to be afraid that mechanical contrivancies for making war are liable to be overdone.

Yet if one thinks carefully and tries to eliminate some of the inventions it is impossible to suggest the abolition of any particular one. In fact the more one thinks over it the more one realizes that the development of mechanical contrivances is in its infancy and that its possibilities are at present indeterminable.

Take for example tanks. We produced an old "bus" which was capable of crushing wire and putting machine guns out of action and the effect was tremendous. Used mostly in trench attacks, it was also successful in more open warfare at the latter end of the war.

It is not too much to assert that after the initial assault at zero hour, no machine gun battalion ever assisted the infantry forward with their fire to anything like the same extent that fewer guns in a tank did.

Petrol and steel against muscle and bone is a formidable opponent.

The development of these vehicles has only just begun and woe betide the nation which neglects their development.

That they will require an antidote is obvious. At present the only one which causes serious inconvenience is artillery. But remember that future tanks may be able to travel at 20 miles per hour and in very large numbers accompanied by artillery either on tanks or drawn bv tractors and the whole problem assumes rather a different aspect.

Infantry and machine guns are powerless against them. The present day horse teams for guns will be as vulnerable as the cavalry and incapable of movement in the presence of tanks.—*The Journal of the Royal Artillery*, September, 1919.

THE GERMAN ARMY.—If the diplomatists, amateur and otherwise, who negotiated the Peace Treaty are persuaded that German militarism has been scotched, they must have abnormal powers of self-deception. At the present moment, when Britain is withdrawing her forces from Archangel, Germany is using her army to substitute herself for the Allies as the savior of Russia. It may or may not be true that she has strong forces with Koltchak, but it is likely, while there is no doubt, whatever, that she has 800,000 well-equipped men along the Polish frontier. As for the Baltic Army of von der Goltz, it is costing 800,000 marks a day. Who is paying for it? Already the Supreme Council of the Allies have issued four ultimatums in succession demanding the withdrawal of German Forces from the Baltic States, only to be contemptuously, if not violently ignored. The truth is that the conditions laid down by the Allies failed to provide for this contingency. Until three months after the ratification of the Peace Treaty no obligation is imposed on Germany to reduce her military forces. She can maintain as many as she pleases and, naturally enough, is making the most of her time. What else could be expected of her? It would be better to recognize that, as we have given her the loophole for agression, it is merely humiliating to send ultimatums which are flouted and to put British officers in the position of being insulted as General Gough was recently by General von der Goltz. But one wonders if German militarism has been so thoroughly crushed as optimistic folk would like to think.—*The Army and Navy Gazette*, 9/27.

ITALIAN BATTLESHIP RAISED.—The Italian Government on September 17 announced a great hydrostatic feat in the raising of Italy's great super-dreadnought, the Leonardo da Vinci, which had been deliberately sunk by the commander in order to save a neighboring town and Italian and Allied warships nearby from the effects of a terrible explosion caused by a clockwork bomb placed on the vessel by some unknown hand. The vessel overturned as it sank, and the heavy guns became imbedded in the sand at the bottom of the sea. It took months of patient, strenuous work to remove the cannon and other equipment, and to bring the gigantic hull to the surface by pumping compressed air into it. At the date mentioned the vessel was ready to be towed into dock and restored to its former value and efficiency.—*The New York Times Current History*, October, 1919.

THE ISLAND OF YAP.—The little Island of Yap in the Pacific Ocean suddenly loomed up as an international question when it developed in a conference between President Wilson and the Senate Foreign Committee that this island was an important cable center and that the United States naval authorities were anxious to have it annexed by the United States.

Yap is the center of a cable system formerly owned by a German cable company. These cables if taken over by the United States would be made to form an integral part of the American cable system already in the Pacific and thus strengthen American trade and commerce, not to speak of the importance of the island and its cable connections from a strategic standpoint.

Up to the time of the outbreak of the war in 1914, the island was owned by the German Government and was the center of a cable system which that government was developing in the Pacific. In 1914 it was seized by the Japanese Government and is being held by that government pending its final disposition by the Allies, but it is understood that Japan is anxious to hold it permanently, together with its cable connections.—*The New York Times Current History,* October, 1919.

GERMANY'S "GAME" IN THE BALTIC REGION.—"Germany lost her colonies, but won Russia," is the pregnant remark attributed to a German officer serving in the Russian Guard Regiment by General Vassilkovsky, a Russian military leader of repute who was at one time commander of the Petrograd forces, and who barely managed to escape death at the hands of the Bolsheviks. He cites this new interpretation of victory in a message to the British people, and sheds great light to some on the significance of the German effort to retain the Baltic region. The Allied authorities are not thoroughly reassured even now that General von der Goltz, as reported, has really transferred his command in the Baltic region to General von Eberhardt, and that German troops are being withdrawn. A semi-official statement reported a complete stoppage of provisions to the insubordinate troops in the Baltic lands except those who were demonstrably returning, and said that all passenger traffic was stopped except empty trains sent to fetch the troops.

More information about the German military movement in the Baltic provinces appears in a letter in the Berlin *Vorwarts,* written by a Social Democrat on his return from that section. He relates that even the smallest places were being occupied by troops and that he saw posters in the office of a military captain which read: "The fight is for the Kaiser and the Empire against Democracy. We will rather die than be dishonored." The orderly of the captain in whose office this poster appeared, according to the *Vorwarts* correspondent, had no doubt but that they would soon put down Noske with his own soldiers. This was easy, "as they had enough friends among Noske's troops, and the democratic government, with all its Jews, would be expelled and the necessary pogroms seen to. The Kaiser's Empire would then be reerected, and the Social Democrats would see how Germans establish order." According to rushed into Lettonia and Courland have been promised recognition as and the *Vorwarts* asks: "Who is paying for these counter-revolutionary bands?" The Paris *Victoire* charges that for months the Germany of Scheidemann, Ebert, and Noske, Socialist Germany, intrigued with the same persistent astuteness as the Germany of Bethmann-Holweg and the Kaiser, and it adds:

"Forced to withdraw its troops from Esthonia and then from a part of Lettonia, or Latvia, the German Government decided to keep them in Courland, where the Allies had the strange notion to seek their kind offices in opposing Bolshevism. In Lettonia, Germany was strong enough to overthrow the autonomous government established by the Letts, and though with the aid of the Allies this government succeeded in reestablishing itself three months later, Germany nevertheless kept right on plotting. Her army, cammanded by von der Goltz, lost no men through demobilization, as did our armies of the east, but was strengthened by volunteers openly enlisted in Berlin. These German volunteers who rushed into Lettonia and Courland have been promised recognition as

citizens of the Lettish Republic and a grant of land in Lettish territory. Thus Germany renounces annexation of the Baltic provinces but reinforces her policy of Germanic colonization. How wonderful, and we never even guessed it! Yet one may imagine how the German troops will conduct themselves towards the Lettish people whom the German barons represent to be an inferior nation. There will be requisitions, thefts and pillage, for the Germans deny themselves nothing, and it may be that after the departure of the Germans an acounting will be demanded from the German barons for the exactions of their soldiers."—*The Literary Digest*, 10/25.

INTERNAL COMBUSTION ENGINED WARSHIPS.—Lord Fisher's recent communications to the *Times*, urging economy and suggesting characteristically sweeping means to that end, have raised afresh some controversial points. The nation is not unmindful of the contribution in the past of Lord Fisher in adopting strong measures to ensure at all costs that the efficiency of the fleet should be maintained at the highest possible value. A reminder is hardly needed of the part played in securing such efficiency of fighting force by the water-tube boiler, the steam turbine, the big gun, and the submarine, or of our indebtedness to Lord Fisher in his advocacy of these important factors. As a result, such improvements were effected in naval engineering that when the war commenced we led the world by a good margin. Lord Fisher also realized at an early date the potentialities of the internal combustion engine as a means of propulsion for fighting ships.

This subject was first raised in a paper before the Institution of Naval Architects given by Sir James McKechnie on March 20, 1907. Later on, it will be remembered, a Royal Commission was set up at the instigation of Lord Fisher, and presided over by him. The findings of this commission have not been made public, but it was generally recognized that the report was a disappointment to Lord Fisher to the extent that it indicated that at the time when the inquiry was held a great amount of development still remained to take place before the internal combustion engine could be regarded as assailing the first place in naval propulsion firmly and justly occupied by the steam turbine. The commission certainly served a useful purpose by the collection of evidence and data which showed clearly the state of the internal combustion engine at that time and indicated the work to be undertaken and the problems to be solved before a reconsideration of the application of the Diesel engine to naval work of high power need arise. Oil having been proved in practice in the interval to be the fuel *par excellence* for naval use, and the Diesel being that type of internal combustion engine best suited to utilize that fuel with maximum economy at relatively high powers (for this class of prime mover) our present remarks may be confined solely thereto.

Lord Fisher's recent letters to the press have given rise in the minds of many engineers to that reconsideration. During the war experiments on such subjects would not have been justified, and reliance was placed rather on combinations of well-tried units, changes being made only after full consideration of the maximum possible detrimental effect on fighting efficiency should the anticipated improvement be completely negatived. Such, however, was the mass of the production of naval machinery undertaken during the war that short steps carried us relatively long distances, and in effect the progress made during this period in most of the branches of naval engineering was greater than in any previous period of time of equal length. The one exception is undoubtedly the Diesel engine. The same 100 brake horsepower per cylinder that was standard in our submarines before the war was the standard, except for minor improvements, at the end. The Germans in their submarines had engines of some 300 brake horsepower per cylinder (see *Engineering*, "German Submarine Diesel Engines," June 13 last, page 763), and the Clyde during the war produced a merchantman with two main engines of 16 Diesel cylinders, developing in normal running at sea a total of 6600 indicated horsepower, or over

330 brake horsepower per cylinder. The engines referred to are the four-cycle single-acting Diesel engines of the motor ship *Glenapp*. The cylinders have a diameter of 760 mm. (29.92 in.) with a stroke of 1100 mm. (43.31 in.) and run at 125 revolutions per minute These are not experimental engines, although much work of such a nature has been undertaken and remains to be recorded. Before the war many rumors concerning Diesel engines building on the Continent for battleships were current. The facts are briefly as follow: The M. A. N. Company, at Nuremberg, built a three-cylinder two-cycle double-acting engine, from which several thousands of horsepower were expected. The results, however, were disappointing, and a serious accident—an explosion in the scavenging system setting fire to the staging and screens erected round the engine for secrecy—which, however, concerned only very indirectly the main principles of the Diesel engine, had the direct effect on the continent of stopping the great amount of experimental work of very similar nature in process at that time. Messrs. Krupp in Germany built a 2000 brake horsepower double-acting two-cycle cylinder, with which no substantial success was achieved. In France Messrs. Schneider, of Le Creusot, under license from Messrs. Carels, of Ghent, constructed a 1000 brake horsepower single-acting two-cycle engine, regarding which no detailed results are available.

Perhaps the most successful of such units was that of Messrs. Sulzer, of Winterthur, where a single-acting two-cycle cylinder of 39.4 in. diameter by 43.3 in. stroke developed at 150 revolutions per minute, it is claimed, 2000 brake horsepower, with a fair measure of success, sufficient, at any rate, to justify the builders in standardizing a two-cycle cylinder of 600 brake horsepower with a cylinder diameter of 29.5 in. and a stroke of 39.4 in., running at 130 revolutions per minute. A six-cylinder engine of these units gives 3600 brake horsepower, and of these several have been built for land work.

These pre-war examples indicate the progress made up to that date, and it must be admitted that the large experimental engines were generally unsuccessful, even although they were designed and built with the one and only aim of giving the maximum horsepower regardless of any other considerations such as weight, compactness, piston speed or speed of revolution. The explanation is to be found in that they were too far ahead of the knowledge at that time of this type of engine. In some cases the experiment may have been justified on the score that the information gained was applicable to and effected improvement with engines of moderate power. The *raison d'être* of this pre-war campaign was that Germany, in many ways the home of the Diesel engine, had lagged behind with the steam turbine, but hoped by intensive development, government fostered, to regain, with this prime mover, the place she had lost on account of our progress meantime with the steam turbine. In this Germany failed, although her engine builders can claim that their largest war submarine engines showed latterly a power capacity per cylinder of nearly three times that achieved by the British standard engine.

Another landmark is the 400-500 brake horsepower submarine unit cylinder of 350 revolutions per minute, designed and built by Messrs. Sulzer during the war, with which highly satisfactory results have, it is believed, been obtained. Six-cylinder engines composed of these units have been built developing 3000 brake horsepower per engine.

These examples indicate in a general way the various steps in the development of the Diesel engine up to the present time. The question then is, can we assess a value to this progress in comparison with the total distance required to be traveled before such prime movers can be considered for first-line fighting units of the fleet? In view of the success of the steam turbine such a consideration will be regarded by some as unnecessary.

The Diesel engine possesses potentialities for fighting ships that demand repeated attention in order that they may be equated to naval requirements if and when the known deficiencies are remedied. The attractions of the

Diesel engine are: Its oil economy, using the most suitable naval fuel, far surpassing the best results achieved by or predicted for the steam turbine; its readiness for immediate service without requiring warming through, etc., the relative ease with which exhaust gases can be discharged compared with these for steam plant, the better arrangements of guns and machinery due to the elimination of the uptakes and the substitution of a relatively small exhaust pipe for funnels. Against these advantages must be set the disadvantages of small power per unit cylinder, the high weight, height and uncertainty of operation, especially with large units, under certain practical conditions.

Instancing three standard powers of naval vessels, the small battle cruiser and the battleship, and light cruiser and torpedo-boat destroyer, the first of 80,000 shaft horsepower, and the others of from 40,000 to 27,000 shaft horsepower, and assuming cylinders of 1000 brake horsepower, 80, 40 and 27 would be required. The maximum number of Diesel cylinders in any vessel afloat is found in the *J* class submarine boats, with their 36 cylinders (three 12-cylinder engines). The maximum number of units which can be regarded as suitable is therefore relatively large. Twelve turbines and more than twelve boilers are not regarded as excessive in steam practice, and 36 cylinders in the case of internal combustion engines have, as already mentioned, proved a sound arrangement.

In respect of increase of power per unit with Diesel engines, progress, it will be seen, has been relatively slow. Up to 300-400 brake horsepower can be said to be proved at the present time to be practical politics. Higher powers still can no doubt be made to give quite satisfactory service, but the demand hitherto has been severely limited by the remarkably rapid success of the application of geared turbine machinery for vessels of all powers, down even to relatively small installations. For naval work, however, the advantages of internal combustion create an insistent demand.

Success in the past with increasing power of Diesel engines has not been achieved without encountering many difficulties. Chiefly, it must be stated, on account of insufficient attention being paid to small and intricate but absolutely essential details, of which with this type of engine there are so many. Knowledge is increasing, and a satisfactory cylinder developing 1000 brake horsepower may confidently be anticipated in the near future. Whether, however, it will meet naval requirements or not is another matter, depending essentially on considerations of weight, space occupied, and such factors. We discussed the future of this type of prime mover in regard to these terms in an article entitled "Internal Combustion Engines for Submarines and Aircraft," published in *Engineering* of September 20, 1918, page 319, and held that the future would see in such work much progress, as has been the case with other prime movers, notably the petrol aero engine. The internal combustion turbine also has been discussed, but still remains no more than a fervent hope.

It is too early yet to speak in any definite way of future naval policy, yet, in all probability, the efforts of the next few years, at any rate, will be concentrated upon the development of those types of fighting units that have proved themselves or have indicated the path of progress. This policy will entail considerable experiment, in which the Diesel engine will not be overlooked. Such work is always costly, and whether or not the results are dearly bought depends largely upon the method of control, the imagination brought to bear, and the careful consolidation of each step gained.—*Engineering*, 9/19.

CURRENT NAVAL AND PROFESSIONAL PAPERS

The Future of the American Merchant Marine. By J. H. Mull (President of Cramp's). *Nautical Gazette*, October 4.

Our Senior Armed Sea Service (Coast Guard). By Robert G. Skerrett. To Revise the Navigation Laws. What is the Government Doing to Shipping. By Henry C. Wiltbank. *The Rudder*, November.

Atmospheric Electricity. By W. F. G. Swann. Optics of the Air. By W. J. Humphreys. The Hiding Power of White Pigments and Paint. By A. H. Pfund. *Journal of the Franklin Institute,* November.

The Internal Combustion Turbine. *Engineering,* September 5. British Tanks in the War. *Engineering,* September 12. The Construction of the U. S. Destroyer *Ward* (illustrated). *Engineering,* October 24.

Economy on the Fleet: Lord Fisher's Demand. By Archibald Hurd. The Empire and Asiatic Immigration. By Vance Palmer. *Fortnightly Review,* October.

The Development of Airplane Motherships. *Schiffbau,* October 22.

ANNOUNCEMENT

Chas. Cory & Son, Inc., main office and factory at 290 Hudson Street, New York, N. Y., have announced the opening of a new branch at 83 Columbia Street, Seattle, Wash., in order that their ships' electrical installation and repair and mechanical communicating work in this district may be more expeditiously handled. The Cory Company announces that it will carry a complete stock of marine electrical appliances and mechanical communication apparatus at their Seattle branch, which will be available for immediate deliveries.

DIPLOMATIC NOTES

FROM OCTOBER 15 TO NOVEMBER 15

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

PEACE TREATY DEBATE IN THE SENATE

THE FIGHT FOR RESERVATIONS.—The United States Senate during October defeated all proposed amendments to the Peace Treaty and the League of Nations Covenant, and proceeded to consideration of the sharply phrased preamble and reservations of the Ratification Resolution as proposed by the majority of the Committee on Foreign Relations. On November 7 the Senate adopted the preamble of the resolution by a vote of 48 to 40, after defeating several attempts to either modify or stiffen its terms. The "Mild Reservationists" voted for the preamble, which was also supported by Senators Gore, Walsh (Mass.), and Reed from the Democratic side.

On November 14 the Senate by a vote of 46 to 33 adopted the second reservation (see following) which modified Article X of the League Covenant, and which was denounced by the President as a knife thrust at the heart of the Treaty. This reservation in effect stated our refusal to assume international obligations and declared that no armed assistance would be given without an act of Congress. On November 19 the Ratification Resolution was defeated by a vote of 41 to 50, and the Senate adjourned.

Text of Ratification Resolution.—The preamble and reservations proposed by the committee read:

Preamble.—The reservations and understandings adopted by the Senate are to be made a part and a condition of the resolution of ratification, which ratification is not to take effect or bind the United States until the said following reservations and understandings adopted by the Senate have been accepted by an exchange of notes as a part and a condition of said instrument of ratification by at least three of the four principal Allied and Associated Powers, to wit, Great Britain, France, Italy, and Japan:

RESERVATION NO. 1

The United States understands and construes Article I that in case of withdrawal from the League of Nations, as provided in said article, the United States shall be the sole judge as to whether all its international obligations and all its obligations under the said covenant have been fulfilled, and notice of withdrawal by the United States may be given by a concurrent resolution of the Congress of the United States.

RESERVATION NO. 2

The United States assumes no obligation to preserve the territorial integrity or political independence of any other country or to interfere in controversies between nations—whether members of the League or not—

under the provisions of Article X, or to employ the military or naval forces of the United States under any article of the Treaty for any purpose, unless in any particular case the Congress, which, under the Constitution, has the sole power to declare war or to authorize the employment of the military or naval forces of the United States, shall by an act or joint resolution, so provide.

RESERVATION NO. 3

No mandate shall be accepted by the United States under Article XXII, part 1, or any other provision of the Treaty of Peace with Germany, except by action of the Congress of the United States.

RESERVATION NO. 4

The United States reserves to itself exclusively the right to decide what questions are within its domestic jurisdiction and declare that all domestic and political questions relating wholly or in part to its internal affairs, including immigration, labor, coastwise traffic, the tariff, commerce, and all other domestic questions, are solely within the jurisdiction of the United States and are not under this treaty to be submitted in any way either to arbitration or to the consideration of the Council or Assembly of the League of Nations or any agency thereof, or to the decision or recommendation of any other power.

RESERVATION NO. 5

The United States will not submit to arbitration by the Assembly or the Council of the League of Nations (provided for in said Treaty of Peace) any questions which in the judgment of the United States depend on or relate to its long-established policy, commonly known as the Monroe Doctrine; said doctrine is to be interpreted by the United States alone and is hereby declared to be wholly outside the jurisdiction of said League of Nations and entirely unaffected by any provision contained in the said treaty of peace with Germany.

RESERVATION NO. 6

The United States withholds its assent to Articles 156, 157, and 158, and reserves full liberty of action with respect to any controversy which may arise under said articles between the Republic of China and the Empire of Japan.

RESERVATION NO. 7

The Congress of the United States by law will provide for the appointment of the representatives of the United States in the Assembly and the Council of the League of Nations, and may in its discretion provide for the participation of the United States in any commission, committee, tribunal, court, council, or conference, or in the selection of any members thereof and for the appointment of members of said commission, committee, court, council, or conference, or any other representatives under the Treaty of Peace, or in carrying out its provisions and until such participation and appointment have been so provided for and the powers and duties of such representative so defined, no person shall represent the United States under either such said League of Nations or the Treaty, or be authorized to perform any act for or on behalf of the United States thereunder, and no citizen of the United States shall be selected or appointed as a member of said commissions, committees, courts, councils, or conferences except with the approval of the Congress of the United States.

RESERVATION NO. 8

The United States understands that the Reparations Commission will regulate or interfere with exports from the United States to Germany, or

from Germany to the United States, only when the United States by its Congress approves such regulation or interference.

RESERVATION NO. 9

The United States shall not be obligated to contribute to any expenses of the League of Nations or secretariat or any commission, committee, or conference or other agency, organized under the League of Nations, or under the Treaty, or for the purpose of carrying out the treaty provisions, unless and until an appropriation of funds available for such expenses shall have been made by the Congress of the United States.

RESERVATION NO. 10

If the United States shall at any time adopt any plan for the limitation of armaments proposed by the Council of the League of Nations under the provisions of Article VIII, it reserves the right to increase such armament without the consent of the Council whenever the United States is threatened with invasion or engaged in war.

RESERVATION NO. 11

The United States construes sub-division "C" of Article XXIII to mean that the League shall refuse to recognize agreements with regard to the traffic in women and children and that the League shall use every means possible to abolish and do away with such practice.

RESERVATION NO. 12

The United States reserves the right to permit, in its discretion, the nationals of a covenant-breaking state, as defined in Article XVI of the covenant of the League of Nations, to continue their commercial, financial and personal relations with the nationals of the United States.

RESERVATION NO. 13

Nothing in Articles 296, 297, or in any of the annexes thereto, or in any other article, provision, section or annex of the Treaty of Peace with Germany shall, as against citizens of the United States, be taken to mean any confirmation, ratification or approval of any act otherwise illegal or in contravention of the rights of citizens of the United States.

(This pertains to the provisions of the sections dealing with alien property.)

GERMANY

GERMANY MUST FULFILL OBLIGATIONS.—Washington, Nov. 6.—The Peace Conference has notified the German Government that the peace treaty will not be put into force until Germany fulfills certain obligations under the armistice which have not yet been carried out.

Unless Germany vests its representatives—sent to Paris for the purpose of signing the procès-verbal, which would put the treaty in force—with full powers to sign at the same time a protocol pledging Germany to carry out certain stipulated conditions, the treaty will not take effect. The allied and associated powers will then have recourse to "any coercive measures" which they may deem appropriate.

Among the considerations set forth in the proposed protocol are requirements that Germany deliver certain vessels in return for the destruction of the German fleet at Scapa Flow within a period of sixty days; that, within ninety days, Germany deliver 400,000 tons of floating docks, cranes, tugs and dredges; that the destroyer *B-98* be surrendered to the Allies; that, within ten days, the machinery and engines of three submarines be also

surrendered to offset the destruction of submarine *C-48*, and that Germany pay the Allied governments the value of certain exported aerial material.

According to the treaty, its terms would come into force from the date of a first procès-verbal to be deposited at Paris. This procès-verbal can be drawn up only after Germany and three of the principal allied and associated powers have deposited at Paris their ratifications of the treaty.

The note to the German Government, which was sent last Saturday night, and is signed by M. Clemenceau as President of the Peace Conference, explains that three allied powers—Great Britain, France and Italy—have now ratified the treaty, and that Germany, having ratified, the conditions have been fulfilled for drafting the first procès-verbal, but unless Germany fulfills certain violated armistice conditions the treaty will not be put into effect.—*N. Y. Times*, 7/11.

DEMAND FOR GERMAN OFFENDERS.—Paris, Nov. 7.—The Supreme Council to-day appointed a commission to make a final draft of the list of Germans charged with war crimes which the Berlin Government will be called on to hand over for prosecution. This commission will also determine the composition and procedure of the tribunal which will conduct the trials of these men.

Two weeks ago the French list of accused Germans, numbering 600, was submitted to the Peace Conference. This list has been somewhat changed, Premier Clemenceau himself having made some alterations. The lists from England and Belgium are now ready, and all these will be incorporated in one big list, carrying after each name a brief summary of the accusations.

A demand for these persons will be served upon Germany immediately after the Peace Treaty goes into effect.—*N. Y. Times*, 8/11.

PLANS FOR PLEBISCITES.—Paris, Nov. 4.—The chairmanship of the inter-allied commission to supervise the plebiscite in Upper Silesia to determine whether this highly important mining region is to belong to Poland or Germany was assigned to France by the Supreme Council to-day. An American representative may head the commission to supervise the plebiscite in Teschen, demanded by Poland and Czechoslovakia, but until ratification of the treaty by the United States France will furnish the chairman of this commission also. The chairmanship for the Allenstein district of East Prussia was assigned to England, and that for Marienwerder, East Prussia, to Italy.

November 10 has been fixed by the Supreme Council as the date when the plebiscite commission created under the German peace treaty shall meet in Paris to discuss the elections in the various areas the political affiliation of which is to be settled by popular vote. The United States will not be represented, even unofficially, at this meeting.

HOLLAND AVERSE TO SURRENDER OF EX-KAISER.—According to an Associated Press report of November 8 the Dutch Government would oppose any effort of the Powers to secure the extradition of the former Kaiser, on the ground that he could not legally be regarded as a criminal. Nor would any effort be made to prevent his return to Germany. On November 12 the former Kaiser took possession of the House of Doorn, at Doorn, Holland, which he had purchased some time before and which he plans to occupy early in 1920.

RUSSIA

BALTIC COMMISSION STARTS WORK.—The Baltic Commission created by the Paris Council and headed by General Niessel of the French Army,

left for Berlin on November 5, with instructions merely to effect the evacuation of Courland by the Germans. While France and England were reported not averse to efforts to "stabilize" conditions in the Baltic provinces of Russia, the American delegates insisted that the commission had but one duty—to effect the evacuation of the Germans. The American delegates were reported to oppose any solution of the Baltic question that would necessitate the dismemberment of the territories formerly in the Russian Empire.

GERMANS DRIVEN FROM RIGA.—Press reports of November 12 stated that on November 11 Lettish troops, supported by the Allied fleet, drove back German-Russian forces near Riga and reoccupied the city.

GERMANS REJECT SOVIET BLOCKADE.—A German press statement of the close of October reported the refusal of the German Government to participate in the Allied blockade of Russia, on the ground that Germany could not against any people take part in a measure by which Germany had suffered so severely. Efforts would be made, however, to prevent food and reinforcements from reaching the German troops that had refused to return from West Russia.

CONFERENCE IN RUSSIA.—Premier Lloyd George announced in Parliament on November 13 that he planned in the near future to suggest an international conference at which representatives of the Allied and Associated Powers might again take up the Russian situation.

ITALY

ITALIAN ELECTIONS ON NOVEMBER 16.—In the Italian elections on November 16 the chief parties represented by candidates were the Socialists and the Popular (Catholic) party. These were the only parties that had well defined and widely diffused political programs. The other parties were for the most part merely followers of individuals—Orlando, Giolitti, Salandra, etc. In a political speech on November 8 ex-Premier Orlando asserted that there had been no change in the Adriatic situation, but that Italy had attained her chief objects in the war by extending her boundaries to the Bremner and thus achieving a defensible frontier.

PROPOSED FIUME SETTLEMENT.—From the Italian Embassy in Washington came a statement in early November to the effect that if Signor Tittoni's recent proposals on the Adriatic question were accepted, D'Annunzio would withdraw from Fiume and leave the final settlement of the question to the Italian Government. In brief, the Tittoni proposals would give Italy practically all of Istria, a certain suzerainty over the town of Zara in Dalmatia, and considerable number of the Dalmatian islands, leaving Fiume and its environs as a buffer state under control of the League, and the main land of Dalmatia in the hands of the Jugoslavs.

AUSTRIA

Peace Treaty Ratified.—On October 17 the Austrian National Assembly ratified the Peace Treaty of St. Germain without debate and with opposition only from the German party. The Treaty was signed on October 25 by Karl Seitz, President of the Austrian Republic.

On November 7 the Temporary Reparations Committee for Austria, after sitting at Vienna for 10 days, submitted a report to the Paris Council. Far from being able to assume payment of large idemnities, Austria, it is said, will require support if she is to remain a separate country, including an initial loan of about $100,000,000.

RUMANIA

On November 4 the Supreme Council sent a note to Rumania demanding an immediate answer to its note of October 12 which requested an explanation of Rumania's arbitrary action in invading Hungary and annexing the former Russian territory of Bessarabia. It appears that Rumania's failure to reply was based on the ground that Italy had not joined in the demand of October 12.

In Paris diplomatic circles it was suggested that both France and Italy, though acquiescing in the Allied protests, were in reality not unwiling to secure favor with Rumania by permitting her to make good by force her territorial desires. This attitude was clearly reflected in the French press.

Still another note to Rumania was despatched on November 7, making a peremptory demand that the Rumanian troops in Hungary be immediately withdrawn.

The reply of Rumania to this last note was evasive and unsatisfactory, expressing a willingness to retire only to the River Theiss and not to the lines established by the Armistice.

BULGARIA

Bulgaria Accepts Treaty.—Paris, Nov. 13.—The Peace Conference has received information from Sofia that the Bulgarian Government has decided to accept and sign the Peace Treaty as presented to the Bulgarian delegation.

The Bulgarian Premier, M. Stambulisky, who left Sofia for Paris yesterday, is expected to sign the treaty to-morrow.—*N. Y. Times*, 14/11.

NEAR EAST

British Withdraw from Syria.—On October 30 the British Government announced an arrangement with France and the King of the Hedjaz in accordance with which British forces would be immediately withdrawn from Syria, and the duties of occupation would be assumed by French and Arabs. No change is indicated in the British policy regarding the final settlement in the Near East, which must follow the signing of the Turkish treaty.

American Control in Turkey Urged.—Henry Morgenthau, ex-Ambassador to Turkey, upon his return from Poland where he headed the Com-

mission to Investigate the Treatment of Jews, launched an appeal for the acceptance by the United States of a mandate for Constantinople, Armenia, and Anatolia. He declared that he had been assured by "leading statesmen" of England that Great Britain urged our acceptance of the mandate on our own terms, welcoming the United States in the Mediterranean as a full partner and offering even joint control of Gibraltar.

In a speech at Sheffield on October 17, Prime Minister Lloyd George also urged American aid in Turkey.

FAR EAST

JAPANESE TROOPS NOT SUBJECT TO SIBERIAN RAILWAY BOARD.—On November 2 the Japanese Government forwarded a reply to the American note sent in September calling attention to the failure of Japanese troops to co-operate in the work of the Inter-Allied Railway Commission in Siberia under John W. Stevens. The Note drew a distinction between military protection of the railroads, which Japan professed willingness to supply, and obedience to the orders and instructions of the Commission, which was in no wise contemplated.

The government, so reads the note, wishes especially to emphasize the fact that the primary duty of the military is the defence of the railway itself, believing that this is vital if the railway is to be operated at all. It is thought, too, that the government of the United States will recognize the great efforts and sacrifices made by the Japanese troops in defence of the railway.

If, however, it is declared in the note, the American Government thinks that the allied military forces should be made subordinate to the Interallied Commission or to the subsidiary technical board, the Japanese Government regrets to say that it is unable to fall in line with that attitude.

However, the Japanese Government would in no case insist that their military forces are under no obligation to co-operate in forwarding the general operation of the railroad. The Japanese troops will put forward all possible efforts to remove anything that stands in the way of the operation of the railroad and will by no means shut their eyes to the perpetration of offences calculated to endanger the lives and property of inspectors and engineers.

Taking up the American references to the instructions to the Japanese military concerning non-interference in case of disputes, the note submits that there seems to be nothing improper in this stand. On the contrary, it thinks that any uncalled-for intervention by Japanese troops in disputes between officials or military forces of the allied powers would be likely to create a grave situation, pregnant with the most undesirable consequences. The object of the Japanese instructions being to avoid the creation of any cause of misunderstanding or ill-feeling, it seems evident what great importance is attached in the instructions to the furtherance of mutual understanding and co-operation.

"It would, therefore, be wide of the mark," it is stated, "to allege that in regard to the general operation of the railway the Japanese troops accept no obligation for co-operation."—*N. Y. Times*, 8/11.

DECLARES JAPAN WILLING TO EVACUATE SIBERIA.—Omsk, Oct. 16.—Count Tsunetada Kato, the special Japanese Ambassador to the All-Russian Government at Omsk, has arrived in Omsk and in a statement to representatives of the press declared that the Japanese troops in Siberia would be

withdrawn whenever the All-Russian Government so desired. In his statement he said:

"The aim of my presence here is to strengthen the bond between the Russian and Japanese people. I assure you that the help coming from the Japanese is entirely disinterested, for a strong and united Russia is as indispensable to Japan as to Russia itself. Bolshevism is as dangerous for Japan as for Russia, and it is of great importance that we prevent its extension in the East.

"As regards Japanese troops in Siberia, their presence depends entirely on the wishes of the Russian Government and if Russia feels that she no longer has need of our troops, we will at once recall them. The Russian people can rest assured that Japan will never permit herself in any way to offend the dignity of Russia."—*N. Y. Times*, 27/10.

MEXICO

UNITED STATES PROTESTS ARMS IMPORTS.—Washington, Nov. 13 (Associated Press).—Large orders for arms and ammunition placed by Mexico in Belgium and Spain, in preparation for the possibility of American intervention, came to light to-day when the State Department let it become known that the government had taken steps to prevent their shipment.

The Chargé d'Affaires of the embassy in Brussels has protested, under instructions, that shipment of the munitions would be in violation of the International Arms Convention. As Spain is not a party to the agreement, which was designed to aid in keeping the peace of the world during the post-war transition period, no such direct action is probable at Madrid.

The order in Belgium was placed with the Fabrique Nationale d'Arms at Liége, probably under the direction of Candido Aguilar, Mexican Minister of Foreign Affairs and President Carranza's son-in-law, who went to Europe recently after stopping here and placing a wreath on George Washington's tomb at Mount Vernon.—*N. Y. Times*, 14/11.

UNITED STATES

LABOR CONGRESS IN WASHINGTON.—The International Labor Conference called in accordance with the decisions of the Paris Peace Conference, began its first session in Washington in October. The opening weeks of the session were taken up with the task of organization and the admission of members. On October 30 the Conference, with but a single opposing vote from the French capital delegate, decided to admit representatives of Germany and Austria to full membership in the world labor organization.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"Elements of Radio Telegraphy." By Lieutenant Ellery W. Stone, U. S. N. R. F. (New York: D. Van Nostrand Company.)

The non-technical student of radio seldom finds a text book in which the subject matter is presented in such a manner as to be interesting from the very start. The above book is an exception to the rule. The dry facts concerning physical phenomena are interspersed with other matter throughout the book and so corelated as to be easily remembered.

The technical student will find in this treatise a store-house of information, much of which is seldom found in text books. Points which are of interest to operators and designers, but which are not essential to the understanding of the elementary theory involved are often omitted from a text in order to simplify or shorten the text. Such points are brought out in full in this book.

The author, an inventor and designer himself, has had a very extended experience in radio work and his explanations and deductions may be accepted as conclusive.

As stated by the author the book is a résumé of a series of lectures and the subject matter is not arranged in the conventional manner of text books in general—a decided advantage to any one but the elementary student.

An unusually complete description and explanation of commercial types of apparatus is presented.

The subject of vacuum tubes is not accorded the treatment deemed desirable by its relative importance in modern radio practice, but the book is excellent withal.

P. L. H.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ARTICLE, 1921

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original article on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the article.

On the opposite page are given suggested topics. Articles are not limited to these topics and no additional weight will be given an article in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original articles published in the PROCEEDINGS during 1920, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1921, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No article received after November 1 will be available for publication in 1920. Articles received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best article published during 1920 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more articles receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all articles be submitted typewritten and in duplicate; articles submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

S. A. TAFFINDER,

Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problems of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

1898

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut. Commander Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903

Gunnery in Our Navy. The Causes of Its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure Its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905

American Naval Policy. Prize, Essay 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear Admiral Stephen B. Luce, U. S. N.

1906

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut. Commander A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906 By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906 By Pay Inspector J. A. Mudd. U. S. N.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A Few Thoughts on Our Next Step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut. Commander Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENCE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut. Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotton, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut. Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut. Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut. Commander Dudley W. Knox, U. S. N.

1914

The Great Lesson from Nelson for To-day. Prize Essay, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

NAVAL POLICY AS IT RELATES TO THE SHORE ESTABLISHMENT AND THE MAINTENANCE OF THE FLEET. Honorable Mention, 1914. By Captain John Hood, U. S. N.

OLD PRINCIPLES AND MODERN APPLICATIONS. Honorable Mention, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

MILITARY PREPAREDNESS. Honorable Mention, 1914. By Naval Constructor Richard D. Gatewood, U. S. N.

1915

The Rôle of Doctrine in Naval Warfare. Prize Essay, 1915. By Lieut. Commander Dudley W. Knox, U. S. N.

AN AIR FLEET: OUR PRESSING NAVAL WANT. First Honorable Mention, 1915. By Lieut. Commander Thomas Drayton Parker, U. S. N.

TACTICS. Second Honorable Mention, 1915. By Ensign H. H. Frost, U. S. N.

DEFENCE AGAINST SURPRISE TORPEDO ATTACK. Third Honorable Mention, 1915. By Ensign R. T. Merrill, 2d, U. S. N.

1916

The Moral Factor in War. Prize Essay, 1916. By Lieutenant (J. G.) H. H. Frost, U. S. N.

NAVAL PERSONNEL. First Honorable Mention, 1916. By Lieut. Commander J. K. Taussig, U. S. N.

EDUCATION AT THE U. S. NAVAL ACADEMY. Second Honorable Mention, 1916. By Lieutenant Ridgely Hunt, U. S. N.

SOME UNDERLYING PRINCIPLES OF MORALE. Third Honorable Mention, 1916. By Commander Dudley W. Knox, U. S. N.

LARGE *vs.* A GREATER NUMBER OF SMALLER BATTLESHIPS. Lippincott Prize Essay. By Lieut. Commander Thomas Lee Johnson, U. S. N.

1917

Commerce Destroying in War. Prize Essay, 1917. By Commander Lyman A. Cotten, U. S. Navy.

THE PEOPLE'S RÔLE IN WAR. First Honorable Mention, 1917. By Lieutenant H. H. Frost, U. S. Navy.

THE NATION'S GREATEST NEED. Second Honorable Mention, 1917. By Colonel Dion Williams, U. S. Marine Corps.

1918

Letters on Naval Tactics. Prize Essay, 1918. By Lieutenant H. H. Frost, U. S. N.

THE PREPAREDNESS OF THE FUTURE. First Honorable mention, 1918. By Commander H. O. Rittenhouse, U. S. N. Retired.

NAVAL STRATEGY. Second Honorable Mention, 1918. By Rear Admiral Bradley A. Fiske, U. S. N.

1919

MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.

SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

INDEX TO VOLUME 45

INDEX TO ADVERTISEMENTS

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

1873-1919

PUBLISHED MONTHLY

EFFECTIVE JANUARY 1, 1920

Annual dues (including subscription) for regular and associate members $3.00, payable upon joining the Institute and upon the first day of each succeeding January. No initiation fee is required.

Subscription to the Proceedings for non-members is $3.50 per annum; enlisted men, U. S. Navy, $3.00 per annum.

Single copies, by purchase, 30 cents; all issues preceding January, 1920, 50 cents.

Postage, at the rate of 50 cents per annum, must be paid on foreign subscriptions.

Subscriptions must be paid for in advance.

Proceedings bound in cloth, $4.00 additional per year, 50 cents of this being for postage.

The Proceedings can be secured through any news agency or direct from the Institute.

Members or subscribers desiring to have their copies of the Proceedings bound in half Morocco may have the work done through the Institute at a price of $2.50 per cover, postage or carriage additional. The Proceedings of each year, stripped and bound, make two conveniently sized volumes.

Remittances should be made payable to the

SECRETARY AND TREASURER

U. S. NAVAL INSTITUTE

ANNAPOLIS, MARYLAND

PUBLICATIONS

U. S. NAVAL INSTITUTE

Publication of books marked with an asterisk (*) has been discontinued. The Institute, however, holds copies which may be obtained until the present edition becomes exhausted.

Catalogue of books published by the Institute containing detailed description and list of contents may be obtained on application to the Secretary and Treasurer, U. S. Naval Institute.

Orders for ***enlisted men*** of books published by the U. S. Naval Institute to the amount of $10.00, or for ten or more of any of said publications. will be furnished at a discount of 10 per cent, carriage prepaid. Additional discounts allowed for special orders in quantities.

NAVIGATION

Navigation and Compass Deviations (Revised 1917, with all problems and solutions brought to accord with the new form of the Nautical Almanac).

By Commander W. C. P. Muir, U. S. Navy, formerly Head of Department of Navigation, U. S. Naval Academy. A practical treatise on navigation and nautical astronomy, including the theory of compass deviation, prepared for use as a text-book at the U. S. Naval Academy. Though written primarily for use of midshipmen, the various subjects have been so presented that any zealous student possessing but a slight knowledge of trigonometry may be able to master the methods given.

12mo, 765 + xvi pages, illustrated by diagrams and many text figures. Price $4.20. Postage paid.

Elements of Hydrographic Surveying (1911).

By Lieut. Commander George Wood Logan, U. S. N. All branches of the work connected with a marine hydrographic survey as ordinarily carried out have been completely described, and the book is, therefore, available for purposes of reference for naval officers and others who may be engaged in such work.

12mo, 176 pages, full cloth. Price $1.50. Postage paid.

A Practical Manual of the Compass.

The revision consists chiefly of the addition of a chapter on service instruments and one on the gyroscopic compass. A valuable book for navigators and officers preparing for promotion.

Originally prepared by Lieut. Commander Harris Laning, U. S. N., for the use of midshipmen to give them a sufficient knowledge of compass work to enable them to efficiently care for and use compasses on board ship. The complex mathematical theory of the deviation of the compass and the derivation of formulæ have been entirely omitted, but a sufficient explanation of causes and effects is given to enable the student to understand any ordinary problem that may arise. The book contains all the most recent data on the subject of compensation of the compass as well as copies of all the forms used in compass work with an explanation of how to use them.

*7 x 10½ in., 146 pages. Bound in flexible cloth. Price **$1.75**. Postage paid.*

MARINE ENGINEERING

Naval Reciprocating Engines and Auxiliary Machinery ("Naval Engines and Machinery").

By Commander John K. Barton, U. S. Navy, Former Head of Department of Marine Engineering and Naval Construction, U. S. Naval Academy. Revised by Comdr. H. O. Stickney, U. S. Navy, recently Head of Department of M. E. and N. C., U. S. Naval Academy.

A text-book for the instruction of midshipmen and for officers preparing for examination, fully illustrated with upwards of 260 text figures, and 48 plates 8 x 10 inches bound separately.

*8vo, 619 pages, full cloth. Price **$4.90**. Postage paid.*

Marine and Naval Boilers.

By Lieut. Commander Frank Lyon, U. S. N., and Lieut. Commander A. W. Hinds, U. S. N. Revised by Lieutenants W. P. Beehler and John S. Barleon, U. S. Navy, of the Department of Marine Engineering and Naval Construction, U. S. Naval Academy, under the supervision of the Head of the Department.

This book was prepared in order to provide an up-to-date text-book for the midshipmen at the U. S. Naval Academy. Plates and descriptions include the most modern boiler installations on naval vessels. The great gain in fuel economy made possible by the combination of gas analysis with intelligent firing is fully described. The causes of boiler corrosion with the practical methods of its prevention are included. A study of the book should furnish all the information necessary for the efficient handling of a boiler plant. This book has been revised to May, 1915.

The book is profusely illustrated by text figures and 16 folding plates.

*8vo, 404 pages. Bound in full cloth. Price **$3.25**. Postage paid.*

The Naval Artificer's Manual, 1918 (Naval Artificer's Hand-Book, 1914, revised).

By Asst. Naval Constructor (T.) McCall Pate, U. S. N., formerly Chief Carpenter, U. S. N.

Appertaining to the care and preservation of the hull and fittings, and the operation of auxiliary machinery on ships of the Navy; containing elementary arithmetic, rules and tables, weights and strength of materials, descriptions of drainage, sanitary and ventilation systems, fire main, flushing systems, steering appliances, telemotors, water-ejecting system, acetylene welding, rules for inspection of lumber, standard formulæ for mixing all kinds of paints used on iron and steel vessels, examination questions pertaining to the various trades of deck artificers, etc.

*797 pages, 126 illustrations, stiff buckram. Price **$2.00.** Postage paid.*

OFFICIAL DRILL BOOKS FOR THE U. S. NAVY

AUTHORIZED BY THE NAVY DEPARTMENT

Landing Force Manual, United States Navy, 1918.

*553 pages, 133 illustrations. Stiff buckram. Price **$1.00.** Postage paid.*

Ship and Gun Drills, U. S. Navy, 1914 (reprinted 1916).

This drill book is designed to cover, so far as practicable, all drills and exercises which are carried out exclusively on board ship.

Illustrated. Cloth binding, price 45 cents. Postage paid.

SEAMANSHIP

The Watch Officer's Manual (1917).

By the late Ensign C. E. Hovey, U. S. Navy. This manual has been revised to bring it in complete accord with present regulations and methods of watch standing and ship handling. New material has been added to round out the work and make it an indispensable assistant to the present day watch officer.

*In flexible cloth, about 90 pages text and 20 pages of colored plates. Price **$1.10,** postpaid.*

Seamanship Department Notes.

Prepared by the Department of Seamanship, U. S. Naval Academy, for use of midshipmen.

Contains notes on the following:
Handling Small Boats,
Ground Tackle,
Mooring Alongside the Dock,
Rules of the Road,
Handling Battleships in Formation,
Hints to Young Officers Taking the Deck,
Writing the Deck Log,
Aids to Learning Signals,
Mooring Board, and
Duties of a Recorder of a Summary Court Martial.

*161 pages, stiff buckram. Price **$1.00,** postpaid.*

Bluejacket's Manual, U. S. Navy (Fifth edition, revised, 1917).

"The Bluejacket's Manual" originally prepared in 1902 by Lieutenant Ridley McLean, U. S. Navy, revised in 1914 to correspond with the provisions of General Order No. 63 of December 16, 1913, and now revised to date by Lieutenant N. R. Van der Veer, U. S. Navy, is issued to the service for the guidance and the instruction of petty officers and enlisted men.

Stiff buckram. Price 75 cents, prepaid.

The Recruit's Handy Book, U. S. Navy (1917).

By Captain W. F. Fullam, U. S. Navy. A most useful primer for the Naval Recruit. It shows him what the navy offers him in the way of a career, and it contains instruction in the rudiments of a seaman's profession.

Flexible buckram cover. Price 20 cents, postpaid.

Routine Book, 1918.

By Captain Reginald R. Belknap, U. S. Navy. A compilation in a concise form of the principles of the organization system applicable to all classes of Naval vessels.

CONTENTS: General Organization.—General Administration.—General Orders.—Honors and Salutes.—Uniform.—Conduct, Liberty, Money.—Delinquencies.—Combination Bill.—Messing Bill.—Berthing Bill.—On Watch in Port.—Duty Bill.—Quarters for Muster and Inspection.—Guard Orders.—Routines.—Cleaning Bill.—Fire Bill.—Collision Bill.—Abandon Ship.—Boat Bill.—Routine Boat Orders.—Man Overboard.—Coaling Bill.—Preparing for Sea.—On Watch at Sea.—Steaming Orders.—Steersmen's General Orders.—Preparing for Harbor.—Water-tight Doors.—Towing Signals.—Docking Bill.—Manning the Rail.—Battalion Bill.—Miscellaneous Notes.—Mess Attendants' Orders.—Ship Handling Notes "A."—Training Course for Signalman and Quartermaster.—Index.—Table Showing Departmental Organization.

308 pages, stiff buckram. Price $2.50. Postage paid.

* Hints for Junior Officers Doing Line Duty.

Lieutenant B. B. Wygant, U. S. Navy.

26 pages, paper cover. Price 15 cents. Postage paid.

ELECTRICAL ENGINEERING

Robison's Manual of Radio Telegraphy and Telephony [formerly Manual of Wireless Telegraphy for the Use of Naval Electricians]. (Fifth edition, revised, 1919.)

By Commander S. S. Robison U. S. Navy. Revised by Commander S. C. Hooper, U. S. Navy, in Charge of Radio Division, Bureau of Steam Engineering.

325 pages text, illustrated. Bound in full white canvas. Price $1.50. Postage paid.

'al Electrician's Text-Book. 2 vols. (1917.)

By Captain W. H. G. Bullard, U. S. Navy, completely revised and largely rewritten by officers and instructors of the Department of Electrical Engineering & Physics, June, 1916–July, 1917.

This work was called into existence by the demand of the naval service for a text book which would teach the theory of electrical engineering, stressing such portions as apply particularly to naval practice; the principles governing the operation and use of electrical equipment; and the special knowledge required for the inspection, care and operation of naval electrical apparatus.

Volume I contains the theoretical study of electricity and the principles of electrical engineering. It covers the practice and principles involved in the construction of all direct current and alternating current machines, instruments, devices and apparatus. Special attention has been given to alternating current theory and to the engineering principles which are involved in the subject of electric drive for naval vessels, and the use of alternating current equipment in the navy afloat and ashore. The section devoted to the subject of radio telegraphy and telephony is unusually complete in its exposition of theory and principles.

Volume II deals with the practical part of naval electrical engineering and contains matter descriptive of generators, motors, distribution systems, auxiliary machinery and miscellaneous apparatus, with principles of operation. Notable features of this volume are the discussion of electrical ship propulsion and electrical equipment of submarines, excellent outlines of interior communication and fire control systems. A very successful effort has been made to eliminate from this volume all unnecessary descriptive and specification matter, and to retain only such material as has value along instructive and operative lines.

Volume I contains 730 pages, 543 illustrations and an appendix containing standardization rules of the A. I. E. E.

Volume II contains 520 pages and 299 illustrations, including seven large folding diagrams.

*Price, bound in full cloth, **$3.75** per volume (2 volumes, **$7.50**), postpaid.*

ORDNANCE

'al Ordnance: Text-Book of Ordnance and Gunnery. Revised Edition, 1915. Corrected to April, 1917.

By Lieut. Commander Roland I. Curtin and Lieut. Commander Thomas L. Johnson, U. S. Navy.

This book has been adopted as a text-book at the U. S. Naval Academy.

*8vo, 383 pages, 57 illustrations, bound in full cloth. Price **$4.85**, postage paid.*

Groundwork of Practical Naval Gunnery, or, Exterior Ballistics. (1914-15.)

By Philip R. Alger, Professor U. S. Navy. Revised and extended to include the formulæ and methods of Colonel James M. Ingalls, U. S. Army, by the officers on duty in the Department of Ordnance and Gunnery, U. S. Naval Academy.

*6½ x 10¼ in., 360 pages, bound in full cloth. Price **$4.50**, postpaid.*

Range and Ballistic Tables.

To be used with Exterior Ballistics.

Reprinted for the use of the Midshipmen of the Naval Academy in connection with their course of study in exterior ballistics. They permit problems to be given covering nearly all the guns in most frequent use in the navy at the present time.

12 x 9½ in. (oblong quarto), 95 pages. Bound in full cloth. Four marginal thumb indexes. Price $2.75, postpaid.

INTERNATIONAL LAW

A Manual of International Law for the use of Naval Officers (1917).

By Rear Admiral C. H. Stockton, U. S. N., Retired. Sometime Lecturer upon International Law at the Naval War College, author of "The Laws and Usages of War at Sea: a Naval War Code."

The aim of this work is to present sound and authoritative information based on the historical and accepted policy of our government, as well as the best and most recent European views upon matters of international law.

A supplementary chapter on the new situations which have arisen during the present war and a complete index have been incorporated in this work.

12mo, 340 pages, cloth. Price $1.50. Postage paid.

STRATEGY AND TACTICS

Naval War College Pamphlets.

The Estimate of the Situation.
The Formulation of Orders.

Paper covers. Price 15 cents each.

Letters on Naval Strategy. Based on the Naval Campaign of 1805.

By Lieutenant Holloway H. Frost, U. S. Navy. Reprinted from the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, Vol. 44, Nos. 6-10, Whole Nos. 184-188.

Paper cover. Price $1.25.

LANGUAGES

A French Nautical Phrase Book and Reader. Revised, 1919.

By Professor P. Jean des Garennes, Department of Modern Languages, U. S. Naval Academy.

Price $1.50.

A Spanish Nautical Phrase Book and Reader. Revised, 1919.

By Professor Arturo Fernandez, Department of Modern Languages, U. S. Naval Academy.

Price $1.50.

MATHEMATICS

Trigonometry and Stereographic Projections. (Revised, 1919.)

By Professor S. J. Brown, U. S. N. Prepared for the use of midshipmen and adopted as a text-book.

8mo, 203 pages, cloth binding. Price $1.35. Postage paid.

MISCELLANEOUS

Physiology, First Aid and Naval Hygiene.

By Comdr. R. C. Heiner (M. C.), U. S. N. A text-book for the Department of Naval Hygiene and Physiology at the U. S. Naval Academy, Annapolis, Md.

This book should be made available for the use of all officers and enlisted men. It is highly recommended to Divisional Officers to be used in the general instruction of their men.

12mo, 139 pages. Bound in full cloth, price $1.00. Postage paid.

U. S. Navy Cook Book (1908).

Prepared by the direction of the Bureau of Navigation at the School for Cooks and Bakers, U. S. Navy Training Station, Newport, Rhode Island. All the methods and recipes given have been tried with success at the Cooking School.

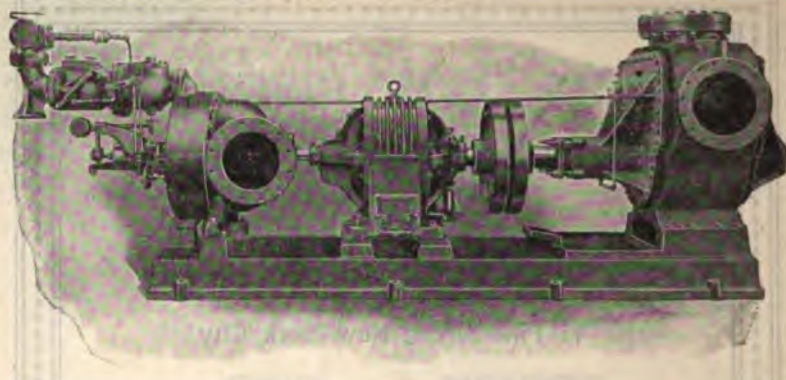
62 pages, flexible library duck. Price 25 cents. Postage paid.

Illustrated Case Inscriptions from the Official Catalogue of the Trophy Flags of the United States Navy.

By Instructor H. C. Washburn, U. S. N. A. **This is a book that** officers in the service will be glad to own and keep at hand as an object lesson to their friends of the navy's history.

133 pages. Paper binding, price 85 cents. Cloth binding, price $1.10. Postage paid.

Please mention the PROCEEDINGS when writing advertisers



Kinney Steam Jacketed Fuel Oil Cargo Pump

Capacities ranging from 25-4000 gallons

The above cut shows the Kinney steam jacketed pump designed for handling 3,000 gallons of heavy Mexican crude oil per minute. It is driven by a 225 HP, General Electric, Type L turbine with a Fast Turbo Speed Reducer, having a speed reduction of 2400 to 200, and connected to the pump by a flexible coupling. The unit is also controlled by a pressure pump governor set at a predetermined point and operated at the discharge side of the pump.

The pump is also equipped with lantern glands to allow the free circulation of oil through the bearings and back to the suction side of the pump which eliminates all the packing trouble experienced in handling all grades of crude oil.

Two of these units have been furnished for the U. S. S. Tank Steamer "Brazos" built at the Boston Navy Yard and four for Tank Steamers No. 17 and 18 for the same yard.

Kinney Manufacturing Co.

Boston, Massachusetts

U. S. NAVAL INSTITUTE
PROCEEDINGS
Number 202